INDEX NUMBER CERCLA 02-2010-2017

QUALITY ASSURANCE PROJECT PLAN
FOR
OU2 SUPPLEMENTAL REMEDIAL INVESTIGATION
(including Baseline Ecological Risk Assessment)

Shieldalloy Metallurgical Site
Newfield, New Jersey

September 2011

Prepared By:

TRC Companies, Inc.
Centre Square, 12th Floor, East Tower
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Philadelphia, PA 19102

210455

QAPP Worksheet #1

1.0 TITLE AND APPROVAL PAGE

Quality Assurance Project Plan for OU2 Supplemental Remedial Investigation, Shieldalloy Metallurgical Site, Newfield, New Jersey
Document Title

United States Environmental Protection Agency
Lead Organization (Agency, State, Tribe, Federal Facility, PRP, or Grantee)

Elizabeth Denly, TRC Environmental Corporation
Preparer's Name and Organizational Affiliation

650 Suffolk Street, Lowell, MA 01854 (978) 970-5600
Preparer's Address and Telephone Number

September 2011
Preparation Date (Day/Month/Year)

Investigative Organization's Project Coordinator: _____
Signature/Date

Patrick Hansen/TRC Environmental
Printed Name/Organization

Investigative Organization's Project Manager: _____
Signature/Date

Jorge Gomez/TRC Environmental
Printed Name/Organization

Investigative Organization's Project QA Manager: _____
Signature/Date

Elizabeth Denly/TRC Environmental
Printed Name/Organization

Laboratory's Project Manager: _____
Signature/Date

Marie Meidhof/Accutest Laboratories
Printed Name/Organization

Laboratory's Project Manager: _____
Signature/Date

Mary Davis/Alpha Analytical Laboratory
Printed Name/Organization

Approval Signatures: _____

Signature/Date

Sherrel Henry/Remedial Project Manager
Printed Name/Title

EPA
Approval Authority

Document Control Number*:* **L2011-116.doc**

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QAPP IDENTIFYING INFORMATION

Site Name/Project Name: Shieldalloy Metallurgical Site, OU2
Site Location: Newfield, New Jersey
Index Number: CERCLA 02-2010-2017
Contractor Name: TRC
Anticipated start date of QAPP Implementation: October 2011

Refer to Section 4.2.1 for information about the document control format

1. Identify guidance used to prepare QAPP:

Uniform Federal Policy for Quality Assurance Project Plans, Intergovernmental Data Quality Task Force, EPA-505-B-04-900A-C, March 2005

2. Identify regulatory program: **CERCLA/Superfund**

3. Identify approval entity: **EPA Region II, NJDEP**

4. Indicate whether the QAPP is a generic program QAPP or a project specific QAPP. (underline one)

5. List dates of scoping meetings that were held:
May 3, 2011

6. List title of QAPP documents and approval dates written for previous site work, if applicable:

Title	Approval Date
Shieldalloy Metallurgical Corporation, Newfield, New Jersey, Remedial Investigation Work Plan, Appendix B, ENSR, December 1989.	**Unknown**

7. List organizational partners (stakeholders) and connection with EPA and/or State:

SMC

8. List data users:

US EPA Remedial Project Manager; NJDEP Case Manager; TRC

9. If any required QAPP Elements (1-20), Worksheets and/or Required Information are not applicable the project, then underline the omitted QAPP Elements, Worksheets and Required Information on the attached Table. Provide an explanation for their exclusion below:

21, 37: These worksheets will not be included in the QAPP. Information specific to each of these worksheets will be discussed in the QAPP text.

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	QAPP Worksheet #
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Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	QAPP Worksheet #
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3.0 DISTRIBUTION LIST AND PROJECT PERSONNEL SIGN-OFF SHEET

3.1 Distribution List

The Distribution List (Worksheet #3) documents who will receive copies of the approved Quality Assurance Project Plan (QAPP) and any subsequent revisions or amendments to the QAPP. A complete copy of the QAPP and any subsequent revisions will be maintained on file at TRC, Philadelphia, Pennsylvania and will be available to EPA upon request.

3.2 Project Personnel Sign-Off Sheet

Project personnel performing OU2 Supplemental Remedial Investigation (RI) and Baseline Ecological Risk Assessment (BERA) work at the Shieldalloy Metallurgical Site will read this QAPP and perform tasks as described in this QAPP. The project personnel sign-off sheet (Worksheet #4) will be used to document that the appropriate personnel have read the QAPP.

Copies of signed project personnel sign-off sheets will be returned to TRC and maintained in the central project file at TRC. These sheets will be made available to EPA upon request.

QAPP Worksheet #3

Distribution List

QAPP Recipients	Title	Organization	Telephone Number	Fax Number	E-Mail Address	Document Control Number
Sherrel Henry	Remedial Project Manager	US EPA Region 2	212-637-4273	212-637-3966	Henry.sherrel@epa.gov	L2011-116
Donna L. Gaffigan	Case Manager	NJDEP	609-633-1494	609-633-1439	Donna.gaffigan@dep.state.nj.us	L2011-116
David White	Environmental Director/Site Representative	SMC	614-599-9582		dwhite@amg-v.com	L2011-116
Patrick Hansen	Project Coordinator	TRC	215-246-3449	215-665-5748	phansen@trcsolutions.com	L2011-116
Jorge Gomez	Project Manager	TRC	609-731-8122	215-665-5748	jgomez@trcsolutions.com	L2011-116
Elizabeth Denly	Project QA Manager	TRC	978-656-3577	978-453-1995	edenly@trcsolutions.com	L2011-116
TBD	Field Team Manager/Site Safety Officer	TRC	TBD	TBD	TBD	L2011-116
Karen Vetrano	Human Health Risk Assessor	TRC	508-420-0754	NA	kvetrano@trcsolutions.com	L2011-116
Scott Heim	Ecological Risk Assessor	TRC	978-656-3583	978-453-1995	sheim@trcsolutions.com	L2011-116
Marie Meidhof	Project Manager	Accutest Laboratories	732-329-0200	732-329-3499	mariem@accutest.com	L2011-116
Mary Davis	Project Manager	Alpha Analytical Laboratory	508-898-9220	508-898-9193	mdavis@alphalab.com	L2011-116

TBD – To Be Determined

QAPP Worksheet #4

Project Personnel Sign-Off Sheet

Organization: TRC Environmental

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Patrick Hansen	Project Coordinator	215-246-3449		
Jorge Gomez	Project Manager	609-731-8122		
Elizabeth Denly	Project QA Manager	978-656-3577		
TBD	Field Team Manager/Site Safety Officer	TBD		
Karen Vetrano	Risk Assessor (Human Health)	508-420-0754		
Scott Heim	Risk Assessor (Ecological)	978-656-3583		

TBD – To Be Determined

QAPP Worksheet #4

Project Personnel Sign-Off Sheet

Organization: EPA Region 2

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Sherrel Henry	Remedial Project Manager	212-637-4273		

Organization: NJDEP

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Donna L. Gaffigan	Case Manager	609-633-1494		

Organization: Analytical Laboratories

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Marie Meidhof/Accutest Laboratories	Project Manager	732-329-0200		
Mary Davis/Alpha Analytical Laboratory	Project Manager	508-898-9220		

4.0 PROJECT ORGANIZATION

This section identifies the organizations and key personnel participating in the Shieldalloy Metallurgical Site (SMC; the Site) project. The specific roles and responsibilities of the key personnel are included in this section. An explanation of the lines of authority, reporting relationships and communication pathways are provided. Qualifications of key personnel are included in the resumes provided in Appendix A.

4.1 Project Organization Chart

Organizations involved in the Shieldalloy Metallurgical OU2 Site project are identified in the project organization chart (Worksheet #5). The responsibilities of key personnel are described in Section 4.3.

4.2 Communication Pathways

The lines of authority and communication specific to this study are also presented in the organization chart (Worksheets #5 and 6). The TRC Project Coordinator will serve as the communication link between EPA and TRC. The TRC Project Coordinator will be kept verbally apprised of the program's status by the TRC Project Manager, TRC Field Team Manager and the TRC Project Quality Assurance (QA) Manager. These individuals will immediately notify the TRC Project Coordinator of any internal or subcontractor issues that potentially affect budget, schedule, and/or achievement of the project objectives. The TRC Project Coordinator will in turn communicate these issues to the EPA Remedial Project Manager. Laboratories will communicate any potential issues to the TRC Project QA Manager who will in turn communicate these issues to the TRC Project Manager. The TRC Project Manager will in turn notify the TRC Project Coordinator of any issues which may potentially affect the achievement of project objectives. The TRC Project Coordinator will in turn notify the EPA Remedial Project Manager of these issues.

New findings, observations, and analytical results will be reported to the TRC Project Manager in the field. Members of the field team will review updated information at the end of each field day, or the following morning prior to the start of daily sampling events. The TRC Project Manager will be in regular communication with the overall project management team to convey the progress and the status of the field investigation. Current findings and implementation of decision rules will be discussed. In addition, any information that may result in a change in scope will also be addressed.

A representative of the project management team will be responsible for providing representatives of the regulatory agencies periodic project updates. At a minimum, such updates will occur when the field team believes that field delineation efforts are nearing completion at an area or medium or in the event of an anticipated scope and/or schedule change. Ideally, representatives from the TRC project team and EPA will be able to meet at the field headquarters to review the findings of the field efforts prior to demobilizing from the Site. In this way, a consensus can be reached with respect to the adequate acquisition of required field information.

4.2.1 Modifications to Approved QAPP

Predetermined changes to the scope or procedures stated in this QAPP will be formally documented as QAPP revisions or as a QAPP Amendment and must go through the same review and approval process as the original QAPP. The control block in the upper right corner of each changed page will be updated to reflect the date of the change and the revision number.

For changes requiring immediate resolution and implementation, approval by phone will be secured from all levels of management (TRC and EPA). This verbal approval will be documented in phone logs and will be followed by formal revision of the QAPP as described above.

If modifications to the QAPP are mandated by the TRC Project Coordinator, the TRC Project QA Manager may schedule a meeting with the appropriate Shieldalloy Metallurgical OU2 Site team members to discuss the changes, make the necessary modifications to the QAPP or create a QAPP Addendum and submit them to the TRC Project Coordinator for review, and submit the revised QAPP or QAPP Amendment to EPA for review and approval. After the QAPP or QAPP Amendment has been approved, the revised QAPP or QAPP Amendment will be provided to the Shieldalloy Metallurgical OU2 Site team members, according to the original QAPP Distribution List. If a revised QAPP is submitted, the old QAPP will be removed and deemed obsolete.

The project personnel sign-off sheet will be resubmitted to the appropriate personnel and will ensure that all appropriate personnel have read the revised QAPP or QAPP Amendment. This sheet will be returned to TRC, stored in the project files, and will be available to EPA upon request.

4.3 Personnel Responsibilities and Qualifications

The responsibilities of management, QA, field, and laboratory personnel are outlined below. Project personnel in responsible roles are identified in Worksheet #7, by name, title and affiliation. The resumes of these key personnel are included in Appendix A.

4.3.1 Management Responsibilities

<u>EPA Remedial Project Manager</u>

The EPA Remedial Project Manager (RPM) for the Site is Ms. Sherrel Henry. Her primary responsibilities include administration of EPA responsibilities, oversight of the day-to-day activities, and receipt of all required written matter. Ms. Henry is also responsible for providing technical oversight and guidance and reviewing all technical deliverables, including plans and reports.

Figure 4-1 Example Phone Log

Telephone Log

Date of Call: _____ Call Placed By: _____

Time of Call: _____ Phone Number: _____

Parties on Call: _____

_____

_____

Subject: _____

_____

_____

Notes: _____

_____

_____

Action Items: _____

_____

_____

NJDEP Case Manager

The NJDEP Case Manager for this Site is Ms. Donna L. Gaffigan. Ms. Gaffigan is responsible for providing to the EPA technical oversight and guidance and reviewing technical deliverables.

TRC Project Coordinator

The TRC Project Coordinator, Mr. Patrick Hansen, will serve as the main contact with the EPA Remedial Project Manager and other regulatory personnel. Other duties, as necessary, include the following:

- Assuring adherence to project plans and obtaining approvals for any changes to these plans,
- Assuring that approved procedures meet project objectives,
- Reviewing and approving all sampling procedures,
- Assigning duties to project staff and orienting the staff to the specific needs and requirements of the project,
- Serving as the focus for coordination of all field task activities, communications, reports, and technical reviews, and other support functions, and facilitating activities with the technical requirements of the project,
- Coordinating field and office activities with the TRC Project Manager, TRC Project QA Manager, and TRC Field Team Manager,
- Implementing recommendations made by the TRC Project QA Manager,
- Initiating corrective actions,
- Monitoring schedules for field, analytical, and data validation activities associated with the field sampling program, and
- Maintaining the project file.

TRC Project Manager

The TRC Project Manager, Mr. Jorge Gomez, will serve as a secondary liaison to EPA and other regulatory personnel and the main contact with the TRC Project Coordinator and TRC Field Team Manager. The TRC Project Manager will ensure that all technical, administrative, and regulatory compliance objectives are met on a day-to-day basis. Other duties as necessary include:

- Assuring adherence to project plans and obtaining approvals for any changes to these plans,
- Assigning duties to project staff and orienting the staff to the specific needs and requirements of the project,
- Assisting in the coordination of all field task activities, communications, reports, and technical reviews, and other support functions, and facilitating activities with the technical requirements of the project,
- Coordinating field and office activities with the TRC Project Coordinator, TRC Project QA Manager, and TRC Field Team Manager,
- Implementing recommendations made by the TRC Project QA Manager,

- Monitoring schedules for field, analytical, and data validation activities associated with the field sampling program,
- Ensuring successful completion of the project in terms of budget, schedule, and data quality objectives, and
- Interpreting site data.

4.3.2 Quality Assurance Responsibilities

TRC Project QA Manager

The TRC Project QA Manager, Ms. Elizabeth Denly, has overall responsibility for quality assurance oversight. The TRC Project QA Manager communicates directly to the TRC Project Coordinator and TRC Project Manager. Specific responsibilities include:

- Preparing the QAPP,
- Reviewing and approving QA procedures, including any modifications to existing approved procedures,
- Ensuring that QA audits of the various phases of the project are conducted as required,
- Providing QA technical assistance to project staff,
- Following up on corrective action,
- Ensuring that data validation/data assessment is conducted in accordance with the QAPP, and
- Reporting on the adequacy, status, and effectiveness of the QA program to the TRC Project Manager.

4.3.3 Field Responsibilities

TRC Field Team Manager/Site Safety Officer

The TRC Field Team Manager and Site Safety Officer have overall responsibility for completion of all field activities in accordance with the QAPP and are the communication link between the field team, subcontractors, and TRC project management. Specific responsibilities include:

- Understanding and implementing the QAPP,
- Coordinating activities in the field,
- Assigning specific duties to field team members,
- Ensuring site security and access,
- Training field staff,
- Overseeing and coordinating field data collection,
- Mobilizing and demobilizing of the field team and subcontractors to and from the Site,
- Resolving any logistical problems that could potentially hinder field activities, such as equipment malfunctions or availability, personnel conflicts, or weather-dependent working conditions,
- Implementing field quality control (QC) including issuance and tracking of measurement and test equipment; the proper labeling, handling, storage, and shipping of samples; chain-of-custody procedures; and control and collection of all field documentation,
- Assisting with report preparation,

- Ensuring all field activities are being implemented in accordance with the Health and Safety Plan,
- Evaluating new hazards and operation changes when necessary, and
- Correcting all noncompliance situations immediately and stopping work in cases of immediate danger.

Field Staff

The field staff reports directly to the TRC Field Team Manager. The responsibilities of the field team include:

- Understanding and implementing QAPP requirements as they relate to their duties,
- Collecting samples, conducting field measurements, and decontaminating equipment according to documented procedures stated in the QAPP,
- Ensuring that field instruments are properly operated, calibrated, and maintained, and that adequate documentation is kept for all instruments,
- Collecting the required QC samples and thoroughly documenting QC sample collection,
- Ensuring that field documentation and data are complete and accurate, and
- Communicating any nonconformance or potential data quality issues to the TRC Field Team Manager.

4.3.4 Laboratory Responsibilities

Analyses will be performed by the following laboratories.

Laboratory	Analyses to Be Performed
Accutest Laboratories 2235 Route 130 Dayton, NJ 08810 1-732-329-0200 Contact: Marie Meidhof	VOCs, SVOCs, PCB Aroclors, Pesticides, Metals, TOC, grain size, pH, Hexavalent Chromium, ORP, hardness
Alpha Analytical Laboratory 320 Forbes Boulevard Mansfield, MA 02048 1-508-898-9220 Contact: Mary Davis	Metals-ICP/MS, Mercury-Atomic Fluorescence

Laboratory Manager

The Laboratory Manager is ultimately responsible for the data produced by the laboratory. Specific responsibilities include:

- Implementing and adhering to the QA and corporate policies and procedures within the laboratory,
- Approving Standard Operating Procedures (SOPs),

- Maintaining adequate staffing, and
- Implementing internal/external audit findings and corrective actions.

Laboratory QA Manager

The Laboratory QA Manager reports directly to the Laboratory Manager. Specific responsibilities include:

- Approving the laboratory SOPs,
- Ensuring and improving quality within the laboratory,
- Supervising and providing guidance and training to laboratory staff,
- Addressing all client inquiries involving data quality issues,
- Performing QA audits and assessments,
- Tracking external and internal findings of QA audits, and
- Coordinating laboratory certification and accreditation programs.

Laboratory Project Manager

The Laboratory Project Manager is the primary point of contact between the laboratory and TRC. Specific responsibilities of the Laboratory Project Manager include:

- Keeping the laboratory and client informed of project status,
- Monitoring, reviewing, and evaluating the progress and performance of projects,
- Reporting client inquiries involving data quality issues or data acceptability to the Laboratory QA Manager and to the operations staff, and
- Reviewing project data packages for completeness and compliance to client needs.

Laboratory Section Leader

Specific responsibilities include:

- Supervising daily activities within the group,
- Supervising QC activities,
- Supervising the preparation and maintenance of laboratory records,
- Evaluating instrument performance and supervising the calibration, preventative maintenance, and scheduling of repairs, and
- Overseeing or performing review and approval of all data.

Laboratory Analyst/Technician

Each analyst or technician is responsible for:

- Performing technical procedures and data recording in accordance with documented procedures,
- Performing and documenting calibration and preventative maintenance,
- Performing data processing and data review procedures,

- Reporting nonconformances to the appropriate personnel, and
- Ensuring sample and data integrity by adhering to internal chain-of-custody procedures.

Laboratory Sample Custodian

The Sample Custodian ensures implementation of proper sample receipt procedures, including maintenance of chain-of-custody. Other specific responsibilities include:

- Notifying the Laboratory Project Manager of any discrepancies or anomalies with incoming samples,
- Logging samples into the laboratory tracking system,
- Ensuring that all samples are stored in the proper environment, and
- Overseeing sample disposal.

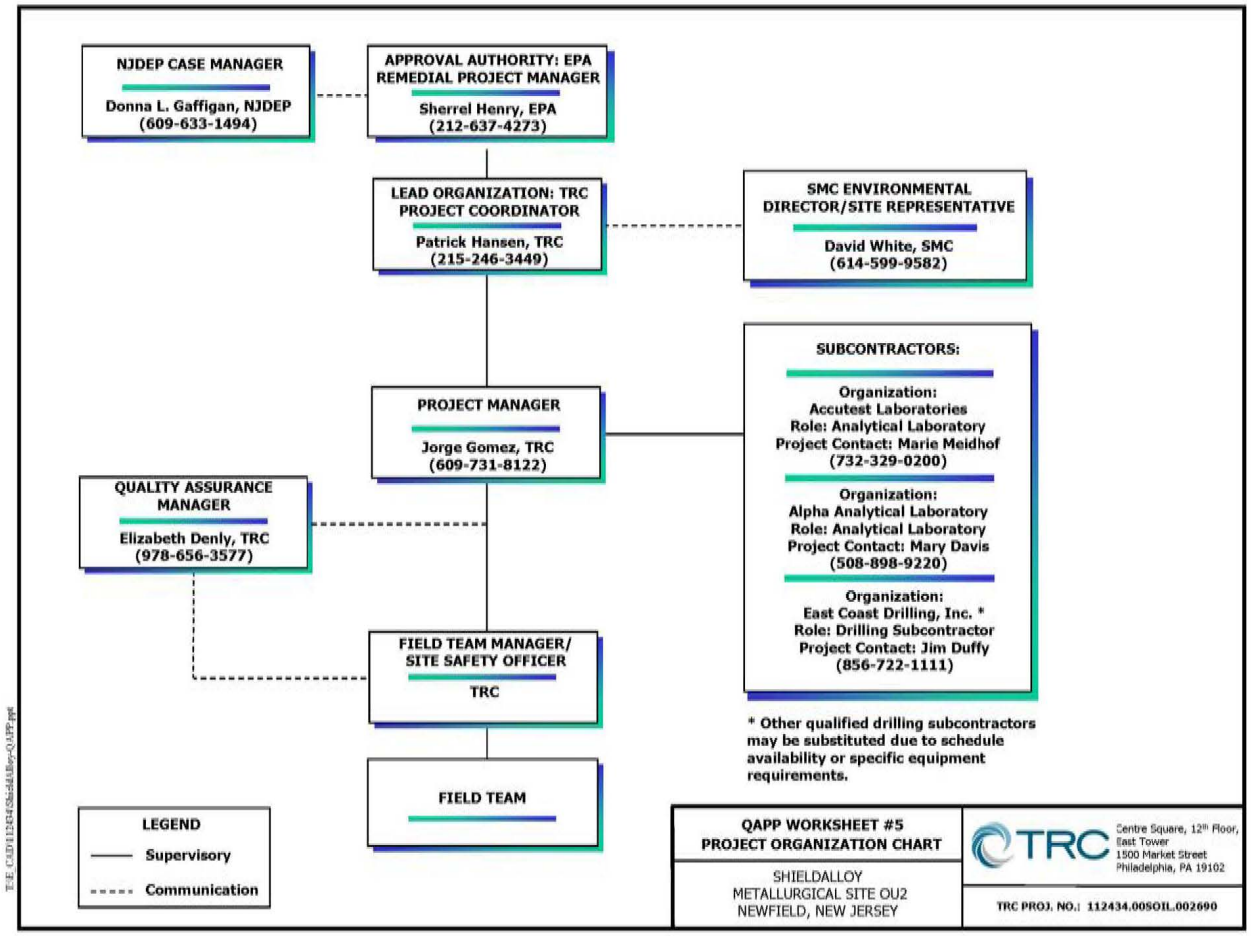
4.3.5 Special Training Requirements/Certification

Most of the activities included in this investigation include routine sampling and analyses with no special training requirements and certifications needed. Staff working on-site will have completed the OSHA/HAZWOPER 40-hour health and safety training and will also have currently (within the past year) completed the OSHA/HAZWOPER 8-hour annual refresher health and safety training. All health and safety training records are maintained in the TRC files. Worksheet #8 summarizes this information. Prior to the start of the investigation, all field personnel will be given instruction specific to the project, covering the following areas:

- Organization and lines of communication and authority,
- Overview of the QAPP, including sample collection, handling, and labeling procedures,
- QA/QC requirements,
- Documentation requirements, and
- Health and safety requirements.

Instructions will be provided by the TRC Project Manager, TRC Field Team Manager, and TRC Project QA Manager.

EPA-NE QAPP Worksheet #5



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QAPP Worksheet #6

Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Primary point of contact with EPA	TRC Project Coordinator	Patrick Hansen	215-246-3449	All deliverables and information about the project will be forwarded to Sherrel Henry by Patrick Hansen.
Manages project phases	TRC Project Manager	Jorge Gomez	609-731-8122	Jorge Gomez will be secondary point of contact with Sherrel Henry and liaison between subcontractors, field staff and Patrick Hansen.
QAPP modifications in the field	TRC Field Team Manager	TBD	TBD	Notify Jorge Gomez and/or Elizabeth Denly by phone of modifications to the QAPP made in the field and the reasons.
Daily progress report	TRC Field Team Manager/Site Safety Officer	TBD	TBD	Provide Jorge Gomez daily updates of progress made in the field, any new hazards or operation changes and all noncompliance situations.
Field and Analytical Corrective Actions	TRC Project QA Manager	Elizabeth Denly	978-656-3577	The need for corrective action for field and analytical issues will be determined by Elizabeth Denly.
Monitoring QA/QC in field and laboratory	TRC Project QA Manager	Elizabeth Denly	978-656-3577	Collection of QC samples at the proper frequency and adherence to required procedures will be monitored by Elizabeth Denly.
Reporting Lab Data Quality Issues	Laboratory Project Managers: Accutest Laboratories Alpha Analytical Laboratory	 Marie Meidhof Mary Davis	 732-329-0200 508-898-9220	All QA/QC issues with project field samples will be reported to Elizabeth Denly by the Laboratory Project Managers within 2 business days.

TBD – To Be Determined

QAPP Worksheet #7

Personnel Responsibilities and Qualifications Table

Name	Title	Organizational Affiliation	Responsibilities(+)	Education and Experience Qualifications
Patrick Hansen*	Project Coordinator	TRC	Oversees project and primary contact with EPA	See Resume, Appendix A
Jorge Gomez*	Project Manager	TRC	Manages project – coordinates field team and subcontractors	See Resume, Appendix A
Elizabeth Denly*	Project QA Manager	TRC	QA oversight and prepares QAPPs	See Resume, Appendix A
TBD	Field Team Manager/Site Safety Officer	TRC	Supervises field sampling and coordinates all field activities	TBD
Karen Vetrano*	Risk Assessor	TRC	Performs human health risk assessment	See Resume, Appendix A
Scott Heim*	Risk Assessor	TRC	Performs ecological risk assessment	See Resume, Appendix A
Marie Meidhof*	Project Manager	Accutest Laboratories	Oversees project in laboratory and main contact with TRC	On file at laboratory
Mary Davis*	Project Manager	Alpha Analytical Laboratory	Oversees project in laboratory and main contact with TRC	On file at laboratory

*Project team members
(+)For more detailed descriptions of responsibilities, refer to Section 4.3.
TBD – To Be Determined

QAPP Worksheet #8

Special Personnel Training Requirements Table

Project Function	Specialized Training Title of Course or Description	Training Provided By	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Field Activities on Superfund Site	OSHA/HAZWOPER 40 hour training	Various trainers	Various	All staff to be used on-site	All	On file at TRC
Field Activities on Superfund Site	OSHA/HAZWOPER 8 hour annual refresher training	Various trainers	Within last year, annually	All staff to be used on-site	All	On file at TRC

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5.0 PROJECT PLANNING/PROJECT DEFINITION

This section documents project planning, identifies the environmental problem, defines the environmental questions that need to be answered, and provides background information.

5.1 Project Planning Meetings

Project planning meetings were held during the development of documents and the planning of project-specific investigations and field tasks. Worksheet #9 provides details on the scoping meeting. Meetings held for the planning of project-specific investigations and data reports will be documented in a similar manner following each meeting.

5.2 Problem Definition/Site History and Background

This section presents an overview of historic information, current site condition descriptions, and other existing data applicable to the project. A more detailed discussion with figures is presented in the companion RI and BERA Work Plans.

5.2.1 Site Location

The Site is located at 35 South West Boulevard, primarily in the Borough of Newfield, Gloucester County, New Jersey. A small portion of the southwest corner of the Facility is located in the City of Vineland, Cumberland County, New Jersey. A site location map is provided as Figure 1 in the RI Work Plan. The SMC Facility comprises approximately 67.7 acres. The approximate center of the Facility is located at latitude 39°32'27.6"N, longitude 75°01'06.7"W. SMC also owns an additional 19.8 acres of farmland, referred to as the "Farm Parcel", located in Vineland, approximately 2,000 feet southwest of the Facility. SMC purchased the Farm Parcel to facilitate the groundwater remediation, which includes a pumping well at this location. This Farm Parcel has never been used for manufacturing or related activities.

Specialty glass manufacturing began at the Site in the early 1900s. SMC manufactured specialty metals at the Site from 1955 to approximately 2007. The Site is currently used as office space and is sublet as warehousing and construction equipment storage space.

The Site is bordered as follows:

- To the north by a former rail spur and a former landfill;
- To the west by Conrail rail lines, West Boulevard, and various light industries and residences;
- To the east by a wooded area, residences and small businesses; and
- To the south by Hudson Branch stream, its associated wetlands/headwaters, and residences (located along Weymouth Road).

The Site is secured by a perimeter chain link fence. The facility parking lot along the western property boundary lies outside of the chain link fence to allow visitor and administrative access.

To understand the nature of the Facility and to assist in the characterization, it is helpful to understand certain sections of the Site, defined by the facility's historic operations, current land cover, and potential future uses. The Site consists of six key areas, namely:

- Former Production Area,
- Former Lagoons Area,
- Eastern Storage Areas,
- Southern Area,
- Natural Resource Restoration Areas, and
- Restricted Area.

A description of the key areas is provided below. A plan depicting the boundaries of these areas and the physical features of the facility areas is provided as Figure 2 in the RI Work Plan.

5.2.1.1 Former Production Area

The Former Production Area is located in the northwest part of the Facility and is the area where the majority of former manufacturing activities occurred. The Former Production Area is approximately 22 acres and is the largest key area.

The Former Production Area is largely covered with buildings and asphalt or concrete pavement. TRC uses Building D216 for the Wastewater Treatment Facility component of the OU1 pump and treat system.

A former Degreasing Unit existed in the Former Production Area in former building D109; it was in periodic service for approximately 2 years (1965-1967). After 1967, the system's operation was discontinued and the entire system was removed from the Site. Trichloroethene (TCE) was the primary degreasing chemical used in the unit.

SMC's future plans for the Former Production Area include the continued use of the buildings for warehousing and construction equipment storage space (or replacement/repair thereof).

5.2.1.2 Former Lagoons Area

The Former Lagoons Area is located in the central portion of the Facility and occupies approximately 4.5 acres. The Former Lagoons Area includes closed lagoons that were used from the 1960s to the 1990s for wastewater treatment. During the 1960s, SMC used one unlined lagoon to hold untreated wastewaters at the location of former lined lagoons B-1, B-2, B-3, B-5, B-6, B-7, B-8, B-11 and B-12 (see Figure 2 of Work Plan). In 1971, this one unlined lagoon was closed and replaced by nine smaller, lined lagoons (B-1, B-2, B-3, B-5, B-6, B-7, B-8, B-11 and B-12) in which the wastewater was treated. In 1987, the wastewater treatment process was modified with aboveground tanks replacing some of the lagoons in the wastewater treatment

process. In May 1992, use of all nine lagoons was discontinued. The nine lagoons were characterized, remediated, and closed from 1994 to 1997. Closure activities included sludge removal, liner removal, contaminated soil removal, post-excavation sampling and backfilling.

Two additional lined basins (B-9 and B-10) were located to the west of the former lagoons. These lined basins were used to contain wastewater associated with an air pollution control process. SMC stopped using the basins in early 1990s. In December 1992, the soils below the basins and the adjacent berm soils were sampled per NJDEP requirements. The analytical results indicated that past activities did not impact the surrounding soils. The lined basins were closed in 1993 and the berm soils were used to backfill the former basins.

Currently, the Former Lagoons Area is covered by light vegetation, which includes small trees and grass. SMC is considering a Brownfields/Brightfields approach for the Site, and is considering the Former Lagoons Area as the area to potentially receive a solar field. If viable, solar arrays would be placed in this area after warranted remedial measures have been implemented.

5.2.1.3 Natural Resource Restoration Areas

Natural Resource Restoration Areas were developed in 1999 and 2000 at designated portions of the Facility to provide habitat value. The Natural Resource Restoration Areas cover approximately 9.65 acres, located in a non-contiguous collection of areas around the Facility, generally focused on the eastern and southern portions.

A Natural Resource Restoration Plan was prepared in October 1997 in accordance with the terms of the USEPA and NJDEP Environmental Settlement Agreement (ESA), which was incorporated into SMC's plan of reorganization pursuant to Chapter 11 of the Bankruptcy Code. In November 1997, the Office of Natural Resource Damage (ONRD) reviewed and approved the Natural Resource Restoration Plan.

To ensure the planted areas are maintained as forest areas, the future use of the planted areas is considered restricted. As such, the nature of these areas cannot be changed, without significant regulatory changes.

5.2.1.4 Eastern Storage Areas

The Eastern Storage Areas, which consist of two separate areas bounding the Restricted Area, are located to the east of the Former Production Area and Former Lagoons Area. These areas were previously used as the By-Product Drum Storage Area and a bone yard.

These areas have never included buildings or offices. Currently, the areas are covered with gravel, light vegetation and piles of concrete debris. Most of these areas were developed and included with the Natural Resource Restoration Tree Planting Area.

SMC is considering this area for potential solar installation, or possibly continued use as storage.

5.2.1.5 Southern Area

The Southern Area is located along the southern property line of the Facility. The Southern Area includes undeveloped areas, the on-site impoundment, the Former Thermal Pond Area, and the Pansy Field. The on-site impoundment, as referenced in the current New Jersey Pollutant Discharge Elimination System (NJPDES) permit, receives a combination of facility stormwater and treated water from the on-site groundwater treatment system. The water from the on-site impoundment is directed into a ditch or unnamed tributary of the Hudson Branch. The on-site impoundment was installed in the early 2000s.

The Former Thermal Pond Area covers approximately 0.77 acres and consists of a rectangular depression area of approximately 3 feet deep. The Former Thermal Pond Area was used on a few occasions as an emergency holding reservoir for treated wastewater. The Former Thermal Pond Area is currently covered with vegetation (grass and small trees).

The Pansy Field covers an area of approximately 2.2 acres and was previously used by local farmers to grow pansies. The Former Pansy Field is included with the Natural Resource Restoration Tree Planting Area. Based on historical aerial photographs, some areas in the Southern Area were used for miscellaneous storage.

Currently, the Southern Area is covered with vegetation that includes grass and small trees. Several areas were developed and included with the Natural Resource Restoration Tree Planting Area; these areas are shown on Figure 2 in the RI Work Plan. Wetlands also exist along the property line to the south.

Because of the nature of this area, its proximity to ditches and wetlands, and its non-contiguous nature, SMC is currently planning on no change for future site use.

5.2.1.6 Restricted Area

The Restricted Area is located in the eastern portion of the Facility and is referred to as a controlled area by the Nuclear Regulatory Commission (NRC). Due to the presence of naturally occurring thorium and uranium in the raw material used for ferro-columbium and the resulting slag and dust, this portion of the Facility is restricted.

A chain link fence with barbed wire surrounds this area (providing a second layer of security from the facilities perimeter fence). Additionally, the Restricted Area is posted with specific signage. Site personnel are trained to stay out of this area, unless specific training and/or escort is provided.

The Restricted Area is not the subject of the OU2 RI.

5.2.2 Site History

Specialty glass manufacturing began at the Facility in 1924. SMC purchased the Site in the early 1950s and, from 1955 to approximately 2007, SMC manufactured specialty steel and super alloy

additives, primary aluminum master alloys, metal carbides, powdered metals and optical surfacing products at the Site. Raw materials used at the Facility included ores which contain oxides of columbium (niobium), vanadium, aluminum metal, titanium metal, strontium metal, zirconium metal, and fluoride (titanium and boron) salts.

SMC made various forms of vanadium in the 1980s and mid-1990s. Vanadium-related production generally occurred in Building D111. The raw material was in the form of an ash, and was transported to the Facility via a variety of containers (e.g., sacks, drums, truck loads). The raw material was stored in the 3-sided "pole building" east of Building D111.

5.2.3 Summary of Previous Investigations

Details on previous investigations are provided in Sections 1.4 and 2.0 of the RI Work Plan. Brief summaries of these investigations are provided below.

Environmental investigations at the Site began in 1972, after the discovery of hexavalent chromium in a well that triggered studies to evaluate the potential environmental impacts associated with SMC's operations. Non-perchlorate groundwater (OU1) has been addressed by a pump and treatment system that has operated since 1979, and is still in operation.

Consequently, the Site has an extensive site characterization history of groundwater, soil, sediment and surface water sampling, as well as remedial activities. The Statement of Work for the OU2 Supplemental RI and Feasibility Study (FS) requires that all existing soil, surface water, and sediment data for the Site be reviewed to identify possible data gaps or areas where data may require updating. Based on a review of the existing data, contaminants of concern (COCs) for OU2 include metals and certain volatile organic compounds (VOCs). A summary of previous soil, surface water, and sediment environmental investigations conducted at the Site are provided below. The results of these investigations and potential data gaps are discussed in Section 2.0 of the RI Work Plan. Worksheet #13 provides a summary of all documents used in this historical data evaluation process.

5.2.3.1 Soil

Surface and subsurface soil investigations were conducted between October 1990 and April 1991 to characterize the soils across the Site. The RI included the collection of 64 surface soil samples, 72 soil borings, and five test pits. The majority of the soil samples were analyzed for Target Analyte List (TAL) metals, boron, niobium, strontium, titanium, and hexavalent chromium. Selected samples were also analyzed for the Target Compound List (TCL) + 30 peaks and zirconium. The results of the RI were included in a 1992 Remedial Investigation Technical Report.

Characterization of soils was conducted at Former Lined Basins B9 and B10 in December 1992. Eight (8) samples were collected beneath the liners and four (4) samples were collected from the berm materials. The soil samples were analyzed for TAL metals and fluoride. Two (2) samples from the basins were also analyzed for TCL VOCs plus boron, niobium, strontium, titanium and zirconium. The field activities and analytical results were included in a 1993 letter report.

A supplemental RI was conducted in August 1995 to delineate the extent of contamination observed during the 1991 RI. The supplemental RI included the collection of 40 surface soil samples and 52 subsurface soil samples. The samples were analyzed for those parameters that required delineation. The results of the supplemental RI were included with a 1996 Draft Final Feasibility Study Report.

On April 11, 1996, representatives of NJDEP, SMC, and TRC collected a total of 22 samples along the Hudson Branch. Seventeen of the 22 samples were classified as soil samples since they were collected at distances between 20 to 80 feet from the stream center. Five of the 22 samples were classified as sediment samples since they were collected from the middle of the stream or within a broad area of diffuse waster flow. Samples were collected beginning at a point downstream of existing sampling station SD-23 and continuing upstream to a point near existing sediment sampling station SD-17 (located between West Boulevard and Weymouth Road). The soil samples were collected from a depth of 0 to 0.5 feet and analyzed for total chromium, vanadium, nickel and copper. The results of the sampling were included in a letter report prepared by TRC and submitted to the NJDEP on May 3, 1996.

Lagoon closure activities were conducted at the site from 1994 to 1997 and included characterization, remediation, and closure of nine wastewater treatment lagoons. Post-excavation soil samples were collected from the base and sidewalls of the lagoons. All samples were analyzed for TAL metals and hexavalent chromium. In addition, two (2) samples per lagoon were analyzed for TCL VOCs, boron, niobium, strontium, titanium and zirconium. The closure activities and analytical results were summarized in a 1999 Closure Report.

A supplemental soil sampling program was conducted in the Former Lagoons B6, B7, and B8 in November 2000. A total of 36 soil samples were collected from the base of the lagoons and analyzed for hexavalent chromium. The results of the investigation were provided in a 2001 Final Supplemental Soil Sampling Report, Former Lagoons B6, B7, and B8.

A supplemental soil sampling program was conducted in the Former Lagoons B1, B2, B3, B5, B11 and B12 in November 2000. A total of 26 soil samples were collected from the base of the lagoons and analyzed for hexavalent chromium. The results of the investigation were provided in a 2001 Final Supplemental Soil Sampling Report, Former Lagoons B1, B2, B3, B5, B11 and B12.

5.2.3.2 Surface Water

A total of five (5) surface water samples were collected from the Hudson Branch in 1990 to determine the presence, nature and extent of surface water contamination. Three (3) surface water samples were analyzed for TAL metals, hexavalent chromium, VOCs, sulfate, fluoride, and total cyanide. The remaining two (2) samples were analyzed for TCL+30, TAL metals, hexavalent chromium, sulfate, cyanide, fluoride, boron, niobium, strontium, titanium, and zirconium. The results of the investigation were included in the 1992 Remedial Investigation Technical Report.

A total of seven (7) surface water samples were collected within the Hudson Branch, Burnt Mill Pond, and Burnt Mill Branch during the supplemental investigation conducted in 1995. The surface water samples were analyzed for TAL metals, hexavalent chromium, and total hardness. The results of the supplemental surface water investigation were summarized in the 1996 Draft Final Feasibility Study Report.

5.2.3.3 Sediment

A total of five (5) stream sediment samples were collected from the Hudson Branch in 1990 to determine the presence, nature and extent of sediment contamination. Three (3) sediment samples were analyzed for TAL metals, hexavalent chromium, VOCs, sulfate, fluoride, and total cyanide. The remaining two (2) sediment samples were analyzed for TCL+30, TAL metals, hexavalent chromium, sulfate, cyanide, fluoride, boron, niobium, strontium, titanium, and zirconium. The results of the sediment investigation were included in the 1992 Remedial Investigation Technical Report.

In August 1995, a total of 27 stations were selected within the Hudson Branch, Burnt Mill Pond, and Burnt Mill Branch to delineate the extent of metal contamination in sediments and define background conditions. The sediment samples were analyzed for TAL metals, hexavalent chromium, total organic carbon (TOC), grain size and pH. Selected sediment samples were also analyzed for TCL pesticides and polychlorinated biphenyls (PCBs). Following an initial review of the August 1995 supplemental sampling results, additional sediment characterization studies were conducted in September 1995. Eight (8) sediment samples were collected for chemical, sediment bioassay and macrobenthic invertebrate bioassessment analyses. The sediment samples were analyzed for TAL inorganics, pH, total organic content, and acid volatile sulfide analysis. The sediment results were included in a 1996 Draft Final Feasibility Study Report.

On April 11, 1996, representatives of NJDEP, SMC, and TRC collected a total of five sediment samples along the Hudson Branch. The sediment samples were collected from the middle of the stream or within a broad area of diffuse waster flow between existing sampling station SD-23 and existing sediment sampling station SD-17 (located between West Boulevard and Weymouth Road). The sediment samples were collected from a depth of 0 to 0.5 feet and analyzed for total chromium, vanadium, nickel and copper. The results of the supplemental sediment sampling were included in a letter report prepared by TRC and submitted to the NJDEP on May 3, 1996.

In March 2009, a total of 19 sediment samples were collected from 13 sampling stations where previous samples were obtained during the 1990 and 1995 sediment investigation to determine the current sediment quality. The sediment samples were analyzed for metals, pH, TOC, and grain size. Selected samples were analyzed for aquatic toxicity characteristics. The field activities and analytical results were summarized in a 2009 letter report.

5.2.4 Contaminants of Potential Concern

SMC and TRC have implemented a series of investigative activities for OU2 from the 1990s to 2009. Extensive environmental data for different media have been collected throughout the years and analyzed for a broad spectrum of constituents. This body of data provides an excellent

basis for OU2 characterization. A summary of previous environmental investigations conducted at the Site was provided in the previous sections. Based on these investigations, the following contaminants of potential concern (COPCs) have been identified in each medium.

Soil

Numerous soil samples were collected across the Site during the RI conducted in October 1990 and the supplemental investigation conducted in August 1995 to characterize soil conditions and evaluate the extent of soil contaminants. Chemical analysis performed on the soil samples varied, depending on the location of samples within various plant process and storage areas. COPCs identified were as follows:

Former Production Area:	vanadium and hexavalent chromium
Former Lagoons Area:	vanadium and hexavalent chromium
Eastern Storage Areas:	vanadium
Southern Area:	vanadium

Surface Water

Surface water samples were collected during the RI conducted in 1990 and supplemental investigations conducted in 1995. COPCs identified were as follows:

Hudson Branch:	metals and trichloroethene
Burnt Mill Pond:	arsenic, chromium, iron, lead, and vanadium
Burnt Mill Branch:	no COPCs were identified

Sediment

Stream sediments were sampled in 1990, 1995, and 2009. COPCs identified were as follows:

Hudson Branch:	metals, SVOCs, and pesticides/PCBs
Burnt Mill Pond:	chromium, antimony, cadmium, mercury, and nickel
Burnt Mill Branch:	cadmium, chromium, copper, lead, mercury, and nickel

QAPP Worksheet #9

Project Scoping Session Participants Sheet

Project Name: Shieldalloy Metallurgical Site, OU2 RI	**Site Name**: Shieldalloy Metallurgical Site, OU2
Projected Date(s) of Sampling: August 2011	**Site Location**: Newfield, NJ
Project Coordinator: Patrick Hansen	

Date of Session: 5/3/11

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Scoping Session Purpose: To review OU2 data, risk, and proposed supplemental RI.

Comments: TRC provided a brief update on the Site overview, a summary of OU2 existing data, an update on the human health risk assessment, an update on the revised SLERA, the proposed supplemental RI and the schedule for the OU2 supplemental RI.

QAPP Worksheet #10

Problem Definition

The problem to be addressed by the project: Refer to Sections 5.2.2, 5.2.3, 6.1, and 8.1

The environmental questions being asked: Refer to Sections 5.2.4, 6.1, and 8.1

Observations from any site reconnaissance reports: Not applicable

A synopsis of secondary data or information from site reports: Refer to Section 5.2.3 and Section 2 of the RI Work Plan

The possible classes of contaminants and the affected matrices: Refer to Section 5.2.4

The rational for inclusion of chemical and nonchemical analyses: Refer to Section 5.2.4

Information concerning various environmental indicators: Refer to Sections 5.2.3 and 5.2.4

6.0 PROJECT QUALITY OBJECTIVES AND MEASUREMENT PERFORMANCE CRITERIA

This section provides an overview of the environmental decisions that need to be made and the level of data quality needed to ensure that these decisions are based on sound scientific data. Additional details are presented in the companion RI and BERA Work Plans.

6.1 Project Quality Objectives

The primary objectives of this RI are as follows:

- Define the nature and extent of contamination in soil, sediment and surface water;
- Develop a sufficient database to support the human health and ecological risk assessments;
- Address identified data gaps; and
- Collect sufficient data to support the revised Feasibility Study.

In addition the primary objectives of the BERA are as follows:

- To assess the bioavailability of the contaminants of potential ecological concern (COPECs);
- To develop an understanding of the relationship between the COPEC concentrations in the sediment and aquatic vegetation and aquatic invertebrates (i.e., bioaccumulation factors);
- To develop an understanding of the relationship between the COPEC concentrations in the surface soil and the terrestrial invertebrates (i.e., bioaccumulation factor); and
- To estimate COPEC exposure by the selected assessment endpoints (herbivorous and insectivorous birds and mammals).

These objectives will be satisfied by the sampling and analysis program outlined in Worksheets #20-1 through 20-5 and 30 (see Section 9.0). These worksheets outline the data needs by type, quantity, and quality.

The type of data needed to meet the project quality objectives (PQOs) includes the required contaminants of concern, concentration levels, media to be sampled, analysis type, and appropriate sampling techniques. These are detailed on Worksheets #15-1 through 15-15 in this section, Worksheets #20-1 through 20-5 in Section 9.0 and Worksheet #30 in Section 13.0, as well as in the text of Section 9.0. The quantity of data needed to meet the PQOs includes the number of samples for each analytical parameter of each media and a definition of the project boundaries. The first of these items is detailed in Worksheets #18-1 through 18-7. The second of these items is dictated by the Work Plans. The quality of data needed to achieve the PQOs includes the necessary data quality indicators (precision, accuracy, representativeness, comparability, completeness, selectivity, and sensitivity) required of each analytical parameter used for each media sampled. The limits set on each of these items are referred to as measurement performance criteria and define the quality of data generated. All measurement performance criteria have been established for each parameter in order to ensure the data are sound, highly defensible, and with low enough quantitation limits to meet human health or ecological risk-based standards.

The contaminants of concern (COCs) are outlined in Worksheets #15-1 through 15-15 and include the project quantitation limits and associated project action levels for each contaminant of concern. The worksheet has been completed for each matrix and each parameter. The project action limits are based on the associated risk-based standard. The risk-based standards were derived from one of the following sources:

- EPA Regional Screening Levels for Industrial Soil, June 2011 (used for sediment and soil).
- USEPA, 2006. EPA Region III BTAG, Freshwater Sediment Screening Benchmarks, August 2006 (used for sediment).
- USEPA National Recommended Water Quality Criteria, Freshwater CCC, 2009 (used for surface water).
- USEPA, 2006. EPA Region III BTAG, Freshwater Screening Benchmarks, July 2006 (used for surface water).
- Soil Remediation Standards, NJDEP, Non-Residential Direct Contact, 11/4/09 (used for soil).
- NJDEP Ecological Screening Criteria, Sediment, Freshwater Criteria, Lowest Effects Levels, 3/10/09 (used for sediment).
- NJDEP Ecological Screening Criteria, Surface Water, Freshwater Criteria, Aquatic/Chronic and Human Health, 3/10/09 (used for surface water).

Action limits which are not achievable are highlighted in Worksheets #15-1 through 15-15 and are not achievable due to analytical limitations of the methods. Laboratories will report quantitation limits as low as technically possible and will estimate values detected below the quantitation limit. It should be noted that project action limits are not applicable for the BERA as the results will not be compared to screening levels, etc. Instead, the data will be used to develop site-specific invertebrate: soil and plant: soil bioaccumulation factors.

In general, the proposed analytical methodologies will be able to achieve the PQOs. That is, the analytical methodologies are generally capable of detecting the target analytes below the applicable action limit. These methods provide the highest level of data quality and can be used for purposes of risk assessment, evaluation of remedial systems and verification that cleanup standards have been met. However, in order to ensure that the analytical methodologies are capable of achieving the data quality objectives, measurement performance criteria have been set for the analytical measurements in terms of accuracy, precision, representativeness, completeness, sensitivity, selectivity, and comparability.

The measurement performance criteria for each parameter are further defined in this section. The number of samples needed for each parameter and matrix were defined in the Work Plans and are summarized on Worksheets #20-1 through 20-5.

6.2 Measurement Performance Criteria

The OU2 Supplemental RI and BERA QA/QC program at the Shieldalloy Metallurgical Site is designed to produce data of the quality necessary to achieve PQOs and meet or exceed the minimum standard requirements for field and analytical methods. The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting which will provide results that are scientifically valid, and the levels of which are

sufficient to meet PQOs. Specific procedures for sampling, chain-of-custody, laboratory and field instruments calibration, laboratory analysis, reporting of data, internal quality control, preventative maintenance of field and laboratory equipment, and corrective action are described in other sections of this QAPP. The purpose of this section is to state the specific, required QA objectives for accuracy, precision, representativeness, completeness, sensitivity, selectivity, and comparability.

Measurement performance criteria for precision, accuracy/bias, representativeness, completeness, sensitivity, quantitation limits, selectivity, and comparability have been established for each matrix and parameter and are summarized in Worksheets #12-1 through 12-12. These measures of performance are also referred to as Data Quality Indicators (DQIs) and are discussed in detail below.

6.2.1 Precision

Precision is the agreement among a set of replicate measurements without consideration of the "true" or accurate value: i.e., variability between measurements of the same material for the same analyte. Precision is measured in a variety of ways including statistically, such as calculating variance or standard deviation.

Field Precision Objectives

Field precision is assessed through the collection and measurement of field duplicates (one extra sample in addition to the original field sample). Field duplicates will be collected at a frequency of one per 20 investigative samples per matrix per analytical parameter. However, field duplicates will not be collected with the aquatic vegetation, aquatic invertebrate, and terrestrial invertebrate samples. Precision will be measured through the calculation of relative percent difference (RPD). The resulting information will be used to assess sample homogeneity, spatial variability at the site, sample collection reproducibility, and analytical variability. Field duplicate RPDs must be $\leq$50 for soil and sediment samples and $\leq$ 30 for surface water samples. Field precision will be improved by following SOPs, utilizing experienced/trained sampling crews, and conducting field audits.

Laboratory Precision Objectives

Precision in the laboratory is assessed through the calculation of RPD for laboratory duplicate samples (two samples from the same container). Laboratory precision measures both sample preparation and analysis reproducibility. Precision control limits are provided in Worksheet #12-1 through 12-12.

For the organic analyses, laboratory precision will be assessed through the analysis of matrix spike/matrix spike duplicate (MS/MSD) samples and/or field duplicates. MS/MSD samples will be performed at a frequency of one per twenty investigative samples per matrix. For the inorganic analyses, laboratory precision will be assessed through the analysis of laboratory duplicate samples. Laboratory duplicate samples will be performed at a frequency of one per twenty investigative samples per matrix.

6.2.2 Accuracy

Accuracy is the closeness of agreement between an observed value and an accepted reference value. The difference between the observed value and the reference value includes components of both systematic error (bias) and random error.

Field Accuracy Objectives

Accuracy in the field is assessed through the adherence to all field instrument calibration procedures, sample handling, preservation, and holding time requirements. Accuracy will also be evaluated through the use of equipment blanks, trip blanks and cooler temperature blanks.

Equipment blanks will be collected by passing laboratory-supplied deionized water over and/or through the respective sampling equipment utilized during each sampling effort. One equipment blank will be collected for each type of non-dedicated field equipment used during each sampling event. Equipment blanks will be collected for each target parameter at a frequency of one per twenty samples; it should be noted that equipment blanks will not be collected for the VOC analyses of soil samples (due to the lack of sampling equipment used), analyses associated with surface water samples (due to the lack of sampling equipment used), and the TOC, pH and oxidation-reduction potential (ORP) analyses of soil and/or sediment samples. Trip blanks will be submitted with each cooler which includes aqueous VOC samples. Trip blank samples will be analyzed for the same VOCs for which the associated media are being analyzed. The equipment and trip blanks will indicate any adverse effects of sample contamination from an outside source (i.e., sample collection) and could result in a positive or negative bias. The bias will be minimized by following standardized SOPs for equipment decontamination, utilizing an experienced/trained sampling crew, conducting field audits, and ensuring the purity of all chemicals.

Laboratory Accuracy Objectives

Laboratories assess the overall accuracy of their instruments and analytical methods (independent of sample or matrix effects) through the measurement of "standards", materials of accepted reference value. Accuracy will vary from analysis to analysis because of individual sample and matrix effects. In an individual analysis, accuracy will be measured in terms of method blank results, the percent recovery (%R) of surrogate or internal standard compounds in organic analyses, or %R of spiked compounds in MSs and/or MSDs, and/or laboratory control samples (LCSs). This gives an indication of expected recovery for analytes tending to behave chemically like the spiked or surrogate compounds and provides a measure of bias for the parameter of interest. Accuracy control limits are provided in Worksheet #12-1 through 12-12. The laboratory method blanks will indicate any adverse effects of sample contamination from an outside source (i.e., sample preparation or sample analysis) and could result in a positive or negative bias.

The frequency of surrogates or internal standards, MSs, MSDs, and LCSs are defined in Worksheets #28-1 through 28-11. Laboratory accuracy will be improved by following the EPA

methods and laboratory SOPs which include detailed requirements for each analysis, utilizing experienced/trained laboratory personnel, ensuring the purity of all chemicals, and conducting laboratory audits.

6.2.3 Representativeness

Representativeness is a qualitative parameter which expresses the degree to which the data and sampling design accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition within a defined spatial and/or temporal boundary. Representativeness is a qualitative parameter which is dependent upon the proper design of the sampling program and the laboratory quality control program.

Measures to Ensure Representativeness of Field Data

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the Work Plans and sampling methods are followed and that proper sampling, sample handling, and sample preservation techniques are used. Representativeness may also be assessed by the use of field duplicate samples. By definition, field duplicate samples are collected so they are equally representative of a given point in space and time. In this way, they provide both precision and representativeness information. As stated previously, field duplicate samples will be collected at a frequency of one per twenty investigative samples per matrix per analytical parameter.

In general, representativeness in the field will be maximized by following methods, proper sample homogenization procedures, proper sample preservation procedures, utilizing experienced/trained sampling crews, and conducting field audits.

Measures to Ensure Representativeness of Laboratory Data

Representativeness in the laboratory is ensured by using the proper analytical procedures, appropriate methods, and meeting sample holding times. Following the detailed requirements outlined in the EPA methods and the laboratory SOPs will maximize the representativeness of the laboratory data.

6.2.4 Comparability

Comparability is a qualitative parameter that expresses the confidence with which one data set can be compared to another.

Measures to Ensure Field Comparability

Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the Work Plans and QAPP are followed, sampling methods are followed, and that proper sampling and preservation techniques are used.

Measures to Ensure Laboratory Comparability

Comparability is dependent on the use of EPA methods and approved laboratory SOPs, and the reporting of data in standardized units.

6.2.5 Selectivity

Selectivity indicates the capability of an analytical method to identify and quantify a target analyte in the presence of non-target analytes of similar chemical structure. For this program, there are no potential selectivity issues with the analyses being performed.

6.2.6 Sensitivity

Sensitivity is the ability of the instrument or method to detect the contaminants of concern at the level of interest. Worksheets #15-1 through 15-15 outline the required quantitation limits for each matrix, each analytical parameter and each analyte. These quantitation limits are generally below the project Action Limits, as defined by the limitations of the method. In almost all cases, EPA methods were selected to achieve the project Action Limits. Several analytes will not be able to achieve the project Action Limits due to the limitations of the method; these analytes are highlighted in Worksheets #15-1 through 15-15.

An evaluation of analytes with quantitation limits (QLs) above Project Action Limits (PALs) is provided below by matrix and parameter.

- Sediment/SVOCs: 2-Chlorophenol, 2,4-dimethylphenol, 2,4-dichlorophenol, acenaphthylene, acenaphthene, 2,4-dinitrotoluene, hexachlorobenzene, atrazine, 3,3'-dichlorobenzidine, benzo(b)fluoranthene, and indeno(1,2,3-cd)pyrene exhibit QLs above the EPA Region III BTAG PAL with a few also above the NJDEP Ecological Screening Criteria. As per Section 13.3 of the QAPP, laboratories will report positive results between the MDL and QL, if detected. For the majority of these compounds, the MDLs are below the Region III BTAG PAL and therefore these compounds would be reported down to this PAL, if detected. With the exception of the PAHs, these compounds are not contaminants of concern at the site and therefore further options were not pursued to lower the QLs.

- Sediment/Pesticides: Toxaphene exhibits a QL above the EPA Region III BTAG PAL. Since this compound is not a contaminant of concern at the site, further options were not pursued to lower the QL.

- Sediment/PCB Aroclors: Aroclor 1016 and Aroclor 1260 exhibit QLs above the NJDEP Ecological Screening Criteria. Since the QLs for total PCBs are still below all PALs, further options were not pursued to lower the QLs for these two individual Aroclors.

- Sediment/Metals and Soil/Metals: Arsenic exhibits a QL slightly above the EPA RSL for Industrial Soil. As per Section 13.3 of the QAPP, laboratories will report positive results

between the MDL and QL, if detected. The MDL of arsenic is below the EPA RSL PAL and therefore arsenic would be reported down to this PAL, if detected. Therefore further options were not pursued to lower the QL.

- Soil/VOCs: Ethylene dibromide and 1,2-dibromo-3-chloropropane exhibit QLs above the NJDEP Non-residential Direct Contact Soil Remediation Standards and/or the EPA RSLs for Industrial Soil. As per Section 13.3 of the QAPP, laboratories will report positive results between the MDL and QL, if detected. For both of these compounds, the MDLs are below the PALs and therefore these compounds would be reported down to these PALs, if detected. In addition, these compounds are not contaminants of concern at the site. Therefore, further options were not pursued to lower the QLs.

- Surface Water/VOCs: Vinyl chloride, carbon disulfide, carbon tetrachloride, 1,2-dichloroethane, benzene, 1,2-dichloropropane, bromodichloromethane, cis-1,3-dichloropropene, trans-1,3-dichloropropene, tetrachloroethene, dibromochloromethane, and 1,2-dichlorobenzene exhibit QLs above the NJDEP Ecological Screening Criteria and/or the EPA Region III BTAG PAL. As per Section 13.3 of the QAPP, laboratories will report positive results between the MDL and QL, if detected. For the majority of these compounds, the MDLs are below the PALs and therefore these compounds would be reported down to these PALs, if detected. In addition, none of these compounds are contaminants of concern at the site. Therefore, further options were not pursued to lower the QLs.

- Surface Water/Metals: Antimony, arsenic, barium, beryllium, cadmium, cobalt, lead, mercury, selenium, silver, and thallium exhibit QLs above one or more of the three PALs. As per Section 13.3 of the QAPP, laboratories will report positive results between the MDL and QL, if detected. For the majority of these metals, the MDLs are below the PALs and therefore these compounds would be reported down to these PALs, if detected. With the exception of arsenic and lead, these metals are not contaminants of concern at the site. For lead, the QL is just slightly above the PAL. For arsenic, the QL is just slightly above one of the PALs and the other PAL would not be achievable even with a different methodology. Therefore further options were not pursued to lower these QLs. For cadmium and selenium, it should be noted that the more sensitive ICP/MS technique is being utilized; due to analytical limitations, lower QLs would not be possible.

Laboratories will need to adjust all quantitation limits based on dilutions, sample sizes, extract/digestate volumes, percent solids and cleanup procedures. In all cases, the adjusted quantitation limit (or sample quantitation limit) must be below the project Action Limit. In establishing the required quantitation limits for this program, these factors were considered in ensuring the project Action Limits would be achieved.

Sensitivity will be maximized by following the EPA methods or laboratory SOPs utilizing experienced/trained laboratory personnel, and conducting laboratory audits.

6.2.7 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. "Normal conditions" are defined as the conditions expected if the sampling plan was implemented as planned.

Field Completeness Objectives

Field completeness is a measure of the amount of (1) valid measurements obtained from all the measurements taken in the project and (2) valid samples collected. The field completeness objective is greater than 90 percent. This allows for the potential loss of samples due to sampling problems or bottle breakage during transport.

Laboratory Completeness Objectives

Laboratory completeness is a measure of the amount of valid measurements obtained from all valid samples submitted to the laboratory. The laboratory completeness objective is greater than 95 percent. This allows for the potential loss of samples impossible to analyze due to unforeseen interferences and rejected data following data validation.

QAPP Worksheet #11

Project Quality Objectives/Systematic Planning Process Statements

Who will use the data?
TRC, USEPA Region 2

What will the data be used for?
Refer to Sections 6.1 and 8.1.

What type of data are needed? (target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)
Refer to Worksheets # 15-1 through 15-15 and Section 9.0.

How "good" do the data need to be in order to support the environmental decision?
Refer to Worksheets # 12-1 through 12-12.

How much data are needed? (number of samples for each analytical group, matrix, and concentration)
Refer to Worksheets # 20-1 through 20-5.

Where, when, and how should the data be collected/generated?
Refer to Sections 8.0 and 9.0.

Who will collect and generate the data?
Refer to Worksheet # 23.

How will the data be reported?
Refer to Section 13.0.

How will the data be archived?
Refer to Section 13.0.

QAPP Worksheet #12-1

Measurement Performance Criteria Table

Matrix	Soil
Analytical Group	VOCs
Concentration Level	High
Sampling Procedure	See Sections 9.2.1 and 9.2.2

Analytical Method/SOP[1]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
L-1	Precision – Overall	*RPD $\leq$ 50 when positive results for both samples are $\geq$ 2x QL *RPD $\leq$ 50 when positive result for one sample is $\geq$ 2x QL and positive result for other sample is < 2x QL *No situations where one result is detected at $\geq$ 2x QL and other result is not detected.	Field Duplicates	S & A
	Precision – Laboratory[2]	RPDs as follows: 1,1-dichloroethene: 26 benzene: 24 chlorobenzene: 26 toluene: 26 trichloroethene: 25	Matrix Spike/ Matrix Spike Duplicate	A
	Accuracy/Bias[2]	Percent recoveries as follows: 1,1-dichloroethene: 32-149 benzene: 41-136 chlorobenzene: 33-140 toluene: 32-145 trichloroethene: 34-149	Matrix Spike/ Matrix Spike Duplicate	A
	Accuracy/Bias	Percent recoveries 70-130	Laboratory Control Sample	A
	Accuracy/Bias – Contamination	No target compounds $\geq$ QL (except methylene chloride and cyclohexane < 2.5x QL and acetone and 2-butanone < 5x QL)	Method Blanks	A
	Accuracy/Bias[2]	Percent recoveries as follows: 1,2-dichloroethane-d_4: 65-132 dibromofluoromethane: 67-127 toluene-d_8: 74-129 bromofluorobenzene: 62-138	Surrogates	A

QAPP Worksheet #12-1

Measurement Performance Criteria Table

Matrix	Soil				
Analytical Group	VOCs				
Concentration Level	High				
Sampling Procedure	See Sections 9.2.1 and 9.2.2				
Analytical Method/SOP[1]		**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
		Accuracy/Bias	Cooler temperature 4ºC ± 2ºC	Cooler Temperature Blank	S
		Data Completeness	Field 90%, Laboratory 95%	Data Completeness Check	S & A

[1] Reference number from QAPP Worksheet #23.
[2] Laboratory control limits are periodically updated. The latest control limits will be utilized at the time of sample analysis. All target VOCs will be evaluated; criteria for select VOCs representing the entire list are presented in this worksheet.

QAPP Worksheet #12-2

Measurement Performance Criteria Table

Matrix	Soil/Sediment
Analytical Group	SVOCs
Concentration Level	Low
Sampling Procedure	Soil: See Sections 9.2.1 and 9.2.2 Sediment: See Section 9.2.3

Analytical Method/SOP[1]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
L-2	Precision – Overall	*RPD ≤ 50 when positive results for both samples are ≥ 2x QL * RPD ≤ 50 when positive result for one sample is ≥ 2x QL and positive result for other sample is < 2x QL * No situations where one result is detected at ≥ 2x QL and other result is not detected.	Field Duplicates	S & A
	Precision – Laboratory[2]	RPDs as follows: 2,4-dinitrotoluene: 28 2-chlorophenol: 24 4-chloro-3-methylphenol: 27 4-nitrophenol: 39 acenaphthene: 26 n-nitroso-di-n-propylamine: 25 pentachlorophenol: 28 phenol: 27 pyrene: 33	Matrix Spike/ Matrix Spike Duplicates	A
	Accuracy/Bias[2]	Percent recoveries as follows: 2,4-dinitrotoluene: 31-123 2-chlorophenol: 41-106 4-chloro-3-methylphenol: 39-122 4-nitrophenol: 13-136 acenaphthene: 38-116 n-nitroso-di-n-propylamine: 30-124 pentachlorophenol: 13-124 phenol: 35-109 pyrene: 23-139	Matrix Spike/ Matrix Spike Duplicates	A

QAPP Worksheet #12-2

Measurement Performance Criteria Table

Matrix	Soil/Sediment
Analytical Group	SVOCs
Concentration Level	Low
Sampling Procedure	Soil: See Sections 9.2.1 and 9.2.2 Sediment: See Section 9.2.3

Analytical Method/SOP[1]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
	Accuracy/Bias[2]	Percent recoveries as follows: 2,4,6-tribromophenol: 28-125 2-fluorobiphenyl: 38-107 2-fluorophenol: 30-109 nitrobenzene d_5: 28-113 phenol-d_5: 28-108 terphenyl-d_{14}: 31-116	Surrogates	A
	Accuracy/Bias	Percent recoveries 40-140	Laboratory Control Sample	A
	Accuracy/Bias – Contamination	No target compounds $\geq$ QL (except phthalates must be $\leq$ 5 x QL)	Equipment Blanks and Method Blanks	S & A
	Accuracy/Bias	Cooler temperature 4ºC $\pm$ 2ºC	Cooler Temperature Blank	S
	Data Completeness	Field 90%, Laboratory 95%	Data Completeness Check	S & A

[1] Reference number from QAPP Worksheet #23.
[2] Laboratory control limits are periodically updated. The latest control limits will be utilized at the time of sample analysis. All target SVOCs will be evaluated; criteria for select SVOCs representing the entire list are presented in this worksheet.

QAPP Worksheet #12-3

Measurement Performance Criteria Table

Matrix	Soil/Sediment
Analytical Group	PCB Aroclors
Concentration Level	Low
Sampling Procedure	Soil: See Sections 9.2.1 and 9.2.2 Sediment: See Section 9.2.3

Analytical Method/SOP[1]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
L-4	Precision – Overall	* RPD ≤ 50 when positive results for both samples are ≥ 2x QL * RPD ≤ 50 when positive result for one sample is ≥ 2x QL and positive result for other sample is < 2x QL * No situations where one result is detected at ≥ 2x QL and other result is not detected.	Field Duplicates	S & A
	Precision – Laboratory[2]	RPDs as follows: Aroclor 1016: 42 Aroclor 1260: 43	Matrix Spike/ Matrix Spike Duplicates	A
	Accuracy/Bias[2]	Percent recoveries as follows: Aroclor 1016: 28-185 Aroclor 1260: 20-190	Matrix Spike/ Matrix Spike Duplicates	A
	Accuracy/Bias	No target analytes ≥ ½ QL	Instrument Blanks	A
	Accuracy/Bias[2]	Percent recoveries as follows: tetrachloro-m-xylene: 22-141 decachlorobiphenyl: 18-163	Surrogates	A
	Accuracy/Bias	Percent recoveries 40-140	Laboratory Control Sample	A
	Accuracy/Bias – Contamination	No target compounds ≥ QL	Equipment Blanks and Method Blanks	S & A
	Accuracy/Bias	Cooler temperature 4ºC ± 2ºC	Cooler Temperature Blank	S
	Data Completeness	Field 90%, Laboratory 95%	Data Completeness Check	S & A

[1] Reference number from QAPP Worksheet #23.
[2] Laboratory control limits are periodically updated. The latest control limits will be utilized at the time of sample analysis.

QAPP Worksheet #12-4

Measurement Performance Criteria Table

Matrix	Soil/Sediment
Analytical Group	Pesticides
Concentration Level	Low
Sampling Procedure	Soil: See Sections 9.2.1 and 9.2.2 Sediment: See Section 9.2.3

Analytical Method/SOP[1]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
L-3	Precision – Overall	* RPD ≤ 50 when positive results for both samples are ≥ 2x QL * RPD ≤ 50 when positive result for one sample is ≥ 2x QL and positive result for other sample is < 2x QL * No situations where one result is detected at ≥ 2x QL and other result is not detected.	Field Duplicates	S & A
	Precision – Laboratory[2]	RPDs as follows: aldrin: 47 dieldrin: 46 endrin: 48 gamma-BHC: 45 heptachlor: 46 4,4'-DDT: 47	Matrix Spike/ Matrix Spike Duplicates	A
	Accuracy/Bias[2]	Percent recoveries as follows: aldrin: 21-171 dieldrin: 22-173 endrin: 26-172 gamma-BHC: 23-163 heptachlor: 27-163 4,4'-DDT: 21-193	Matrix Spike/ Matrix Spike Duplicates	A
	Accuracy/Bias	No target analytes ≥ ½ QL	Instrument Blanks	A
	Accuracy/Bias	Percent breakdown of DDT and Endrin must be ≤ 20; combined percent breakdown must be ≤ 30	Endrin/DDT Breakdown Standard	A

QAPP Worksheet #12-4

Measurement Performance Criteria Table

Matrix	Soil/Sediment
Analytical Group	Pesticides
Concentration Level	Low
Sampling Procedure	Soil: See Sections 9.2.1 and 9.2.2 Sediment: See Section 9.2.3

Analytical Method/SOP[1]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
	Accuracy/Bias[2]	Percent recoveries as follows: tetrachloro-m-xylene: 23-137 decachlorobiphenyl: 22-160	Surrogates	A
	Accuracy/Bias	Percent recoveries 40-140	Laboratory Control Sample	A
	Accuracy/Bias – Contamination	No target compounds $\geq$ QL	Equipment Blanks and Method Blanks	S & A
	Accuracy/Bias	Cooler temperature 4ºC $\pm$ 2ºC	Cooler Temperature Blank	S
	Data Completeness	Field 90%, Laboratory 95%	Data Completeness Check	S & A

[1] Reference number from QAPP Worksheet #23.
[2] Laboratory control limits are periodically updated. The latest control limits will be utilized at the time of sample analysis. All target pesticides will be evaluated; criteria for select pesticides representing the entire list are presented in this worksheet.

QAPP Worksheet #12-5

Measurement Performance Criteria Table

Matrix	Soil/Sediment/Tissue*
Analytical Group	Metals
Concentration Level	Low
Sampling Procedure	Soil: See Sections 9.2.1 and 9.2.2 Sediment: See Section 9.2.3 Tissue: See Section 9.2.4

Analytical Method/SOP[1]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
L-5, L-8, L-13	Precision – Overall	*RPD $\leq$ 50 when positive results for both samples are $\geq$ 5x QL *Absolute difference < 4x QL when positive results for both samples are < 5x QL *RPD $\leq$ 50 when positive result for one sample is $\geq$ 5x QL and positive result for other sample is < 5x QL *No situations where one result is detected at $\geq$ 5x QL and other result is not detected.	Field Duplicates	S & A
	Precision – Laboratory	RPD $\leq$ 35 if results are $\geq$ 5x QL	Laboratory Duplicates	A
	Accuracy/Bias	L-5 and L-8: Percent recoveries 75 – 125% L-13: Percent recoveries 80 – 120%	Matrix Spikes	A
	Accuracy/Bias	L-5 and L-8: Within EPA or vendor control limits L-13: Percent recoveries 80 – 120%	Laboratory Control Sample	A
	Accuracy/Bias	$\pm$ 10% of original result	Serial Dilution Analysis	A
	Accuracy/Bias	Percent recoveries 70 – 130%	Detection Limit Standard	A
	Accuracy/Bias	Percent recoveries 80 – 120%	Interference Check Sample	A
	Accuracy/Bias (ICP/MS only)	30-120% of IS in blank or calibration standard	Internal Standards	A
	Accuracy/Bias - Contamination	No target compounds $\geq$ QL	Initial Calibration Blanks, Continuing Calibration Blanks, Preparation Blanks, and Equipment Blanks	S & A

QAPP Worksheet #12-5

Measurement Performance Criteria Table

Matrix	Soil/Sediment/Tissue*				
Analytical Group	Metals				
Concentration Level	Low				
Sampling Procedure	Soil: See Sections 9.2.1 and 9.2.2 Sediment: See Section 9.2.3 Tissue: See Section 9.2.4				
Analytical Method/SOP[1]		**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
		Accuracy/Bias	Cooler temperature 4ºC ± 2ºC	Cooler Temperature Blank	S
		Data Completeness	Field 90%, Laboratory 95%	Data Completeness Check	S & A

[1] Reference number from QAPP Worksheet #23.
*Aquatic vegetation, aquatic invertebrates, terrestrial invertebrates, earthworms

QAPP Worksheet #12-6

Measurement Performance Criteria Table

Matrix	Sediment
Analytical Group	TOC
Concentration Level	NA
Sampling Procedure	See Section 9.2.3

Analytical Method/SOP[1]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
L-6	Precision – Overall	*RPD $\leq$ 50 when positive results for both samples are $\geq$ 2x QL *RPD $\leq$ 50 when positive result for one sample is $\geq$ 2x QL and positive result for other sample is < 2x QL *No situations where one result is detected at $\geq$ 2x QL and other result is not detected.	Field Duplicates	S & A
	Precision – Laboratory	RPD $\leq$ 20	Laboratory Duplicate	A
	Accuracy/Bias	Percent recoveries 75-125%	Matrix Spike	A
	Accuracy/Bias	Percent recoveries 90-110%	Laboratory Control Sample	A
	Accuracy/Bias – Contamination	No target analytes > QL	Method Blanks	A
	Accuracy/Bias	Cooler temperature 4ºC $\pm$ 2ºC	Cooler Temperature Blank	S
	Data Completeness	Field 90%, Laboratory 95%	Data Completeness Check	S & A

[1] Reference number from QAPP Worksheet #23.

QAPP Worksheet #12-7

Measurement Performance Criteria Table

Matrix	Soil/Sediment
Analytical Group	pH and ORP
Concentration Level	NA
Sampling Procedure	Soil: See Sections 9.2.1 and 9.2.2 Sediment: See Section 9.2.3

Analytical Method/SOP[1]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
L-9 and L-11	Precision – Overall	RPD $\leq$ 10	Field Duplicates	S & A
	Precision – Laboratory	RPD $\leq$ 5	Laboratory Duplicate	A
	Accuracy/Bias	Cooler temperature $4^{o}C \pm 2^{o}C$	Cooler Temperature Blank	S
	Data Completeness	Field 90%, Laboratory 95%	Data Completeness Check	S & A

[1] Reference number from QAPP Worksheet #23.

QAPP Worksheet #12-8

Measurement Performance Criteria Table

Matrix	Soil
Analytical Group	Hexavalent Chromium
Concentration Level	Low
Sampling Procedure	See Sections 9.2.1 and 9.2.2

Analytical Method/SOP[1]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
L-10	Precision – Overall	*RPD $\leq$ 50 when positive results for both samples are $\geq$ 2x QL *RPD $\leq$ 50 when positive result for one sample is $\geq$ 2x QL and positive result for other sample is < 2x QL *No situations where one result is detected at $\geq$ 2x QL and other result is not detected.	Field Duplicates	S & A
	Precision – Laboratory	RPD $\leq$ 20	Laboratory Duplicate	A
	Accuracy/Bias	Percent recoveries 75-125%	Matrix Spike	A
	Accuracy/Bias	Percent recoveries 80-120%	Laboratory Control Sample	A
	Accuracy/Bias – Contamination	No target analytes > QL	Method Blanks and Equipment Blanks	S & A
	Accuracy/Bias	Cooler temperature 4ºC $\pm$ 2ºC	Cooler Temperature Blank	S
	Data Completeness	Field 90%, Laboratory 95%	Data Completeness Check	S & A

[1] Reference number from QAPP Worksheet #23.

QAPP Worksheet #12-9

Measurement Performance Criteria Table

Matrix	Surface Water
Analytical Group	VOCs
Concentration Level	Low
Sampling Procedure	See Section 9.2.3

Analytical Method/SOP[1]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
L-1	Precision – Overall	*RPD $\leq$ 30 when positive results for both samples are $\geq$ 2x QL *RPD $\leq$ 30 when positive result for one sample is $\geq$ 2x QL and positive result for other sample is < 2x QL *No situations where one result is detected at $\geq$ 2x QL and other result is not detected.	Field Duplicates	S & A
	Precision – Laboratory[2]	RPDs as follows: 1,1-dichloroethene: 17 trichloroethene: 15 benzene: 13 toluene: 14 chlorobenzene: 12	Matrix Spike/ Matrix Spike Duplicates	A
	Accuracy/Bias[2]	Percent recoveries as follows: 1,1-dichloroethene: 41-144 trichloroethene: 53-141 benzene: 38-139 toluene: 44-141 chlorobenzene: 65-128	Matrix Spike/ Matrix Spike Duplicates	A
	Accuracy/Bias[2]	Percent recoveries as follows: dibromofluoromethane: 76-120 1,2-dichloroethane-d_4: 64-135 toluene- d_8: 76-117 bromofluorobenzene: 72-122	Surrogates	A
	Accuracy/Bias	Percent recoveries 70-130%	Laboratory Control Sample	A
	Accuracy/Bias – Contamination	No target compounds $\geq$ QL (except methylene chloride, acetone and 2-butanone < 2x QL)	Trip Blanks and Method Blanks	S & A

QAPP Worksheet #12-9

Measurement Performance Criteria Table

Matrix	Surface Water				
Analytical Group	VOCs				
Concentration Level	Low				
Sampling Procedure	See Section 9.2.3				
Analytical Method/SOP[1]		**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
		Accuracy/Bias – Contamination	No target compounds $\geq$ QL	Instrument Blanks	A
		Accuracy/Bias	Cooler temperature $4^{o}C \pm 2^{o}C$	Cooler Temperature Blank	S
		Data Completeness	Field 90%; Laboratory 95%	Data Completeness Check	S & A

[1] Reference number from QAPP Worksheet #23.
[2] Laboratory control limits are periodically updated. The latest control limits will be utilized at the time of sample analysis. All target VOCs will be evaluated; criteria for select VOCs representing the entire list are presented in this worksheet.

QAPP Worksheet #12-10

Measurement Performance Criteria Table

Matrix	Surface Water
Analytical Group	Metals (Total and Dissolved)
Concentration Level	Low
Sampling Procedure	See Section 9.2.3

Analytical Method/SOP[1]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
L-5 and L-8	Precision – Overall	*RPD $\leq$ 30 when positive results for both samples are $\geq$ 5x QL *Absolute difference < 2x QL when positive results for both samples are < 5x QL *RPD $\leq$ 30 when positive result for one sample is $\geq$ 5x QL and positive result for other sample is < 5x QL *No situations where one result is detected at $\geq$ 5x QL and other result is not detected.	Field Duplicates	S & A
	Precision – Laboratory	RPD $\leq$ 20 if results are $\geq$ 5 x QL	Laboratory Duplicates	A
	Accuracy/Bias	Percent recoveries 75 – 125%	Matrix Spikes	A
	Accuracy/Bias	Percent recoveries 80 – 120%	Laboratory Control Sample	A
	Accuracy/Bias	$\pm$ 10% of original result	Serial Dilution Analysis	A
	Accuracy/Bias	Percent recoveries 80 – 120%	Interference Check Sample	A
	Accuracy/Bias (ICP/MS only)	30-120% of IS in blank or calibration standard	Internal Standards	A
	Accuracy/Bias - Contamination	No target compounds $\geq$ QL	Initial Calibration Blanks, Continuing Calibration Blanks, and Preparation Blanks	A
	Accuracy/Bias	Cooler temperature 4ºC $\pm$ 2ºC	Cooler Temperature Blank	S
	Data Completeness	Field 90%, Laboratory 95%	Data Completeness Check	S & A

[1] Reference number from QAPP Worksheet #23.

QAPP Worksheet #12-11

Measurement Performance Criteria Table

Matrix	Surface Water
Analytical Group	Total Hardness
Concentration Level	Low
Sampling Procedure	See Section 9.2.3

Analytical Method/SOP[1]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
L-12	Precision – Overall	* RPD ≤ 30 when positive results for both samples are ≥ 5x QL * Absolute difference < 2x QL when positive results for both samples are < 5x QL * RPD ≤ 30 when positive result for one sample is ≥ 5x QL and positive result for other sample is < 5x QL * No situations where one result is detected at ≥ 5x QL and other result is not detected.	Field Duplicates	S & A
	Precision – Laboratory	RPD ≤ 20	Laboratory Duplicates	A
	Accuracy/Bias	Percent recoveries 75-125%	Matrix Spikes	A
	Accuracy/Bias	Percent recoveries 80-120%	Laboratory Control Sample	A
	Accuracy/Bias – Contamination	Target analytes must be ≤ QL	Method Blanks	A
	Accuracy/Bias	Cooler temperature 4ºC ± 2ºC	Cooler Temperature Blank	S
	Data Completeness	Field 90%, Laboratory 95%	Data Completeness Check	S & A

[1] Reference number from QAPP Worksheet #23.

QAPP Worksheet #12-12

Measurement Performance Criteria Table

Matrix	Surface Water				
Analytical Group	Hexavalent Chromium (total and dissolved)				
Concentration Level	Low				
Sampling Procedure	See Section 9.2.3				
Analytical Method/SOP[1]		**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
L-10		Precision – Overall	*RPD $\leq$ 30 when positive results for both samples are $\geq$ 2x QL *RPD $\leq$ 30 when positive result for one sample is $\geq$ 2x QL and positive result for other sample is < 2x QL *No situations where one result is detected at $\geq$ 2x QL and other result is not detected.	Field Duplicates	S & A
		Precision – Laboratory	RPD $\leq$ 20	Laboratory Duplicate	A
		Accuracy/Bias	Percent recoveries 75-125%	Matrix Spike	A
		Accuracy/Bias	Percent recoveries 80-120%	Laboratory Control Sample	A
		Accuracy/Bias – Contamination	No target analytes > QL	Method Blanks	A
		Accuracy/Bias	Cooler temperature 4ºC $\pm$ 2ºC	Cooler Temperature Blank	S
		Data Completeness	Field 90%, Laboratory 95%	Data Completeness Check	S & A

[1] Reference number from QAPP Worksheet #23.

7.0 SECONDARY DATA EVALUATION

This section of the QAPP identifies the sources of previously collected data and information that will be used to make project decisions. These sources were used to design the sampling program. Worksheet #13 includes the non-direct measurement data/information that will be used for this project and the originating source.

QAPP Worksheet #13

Secondary Data

The scope of work for the Shieldalloy Metallurgical Site OU2 Supplemental RI and BERA was based on a review of existing data from 1990-1997, 2000 and 2009. The data were included in data packages and reports. Media sampled included surficial and subsurface soils, sediment and surface water. As per the Statement of Work for the OU2 Supplemental RI, existing data listed below were reviewed to identify possible data gaps or areas where data may require updating. The existing data forms the initial base to evaluate site conditions and further Supplemental RI and BERA activities will build on these data. The sources of the data are as follows:

NJDEP, 2001. Basin Closure, NJDEP letter, August 10, 2001.

Schoor DePalma, 1994. Environmental Report, Wetlands and State Open Waters Delineation, Shieldalloy Metallurgical Corporation, Newfield, New Jersey, Schoor DePalma, May 1994.

TRC, 1992. Remedial Investigation Technical Report, Shieldalloy Metallurgical Corporation, Newfield, New Jersey, TRC Environmental Corporation, April 1992.

TRC, 1993. Soil Sampling Results, Former Lagoons B9 and B10, Shieldalloy Metallurgical Corporation, Newfield, New Jersey, TRC Environmental Corporation, March 1993.

TRC, 1995. Closure Plan-Surface Impoundments B-1, B-2, B-3, B-5, B-11 and B-12, Shieldalloy Metallurgical Corporation, Newfield, New Jersey, TRC Environmental Corporation, August 1995.

TRC, 1996a. Draft Final Feasibility Study Report, Shieldalloy Metallurgical Corporation, Newfield, New Jersey, TRC Environmental Corporation, April 1996.

TRC, 1996b. Supplemental Wetland Sediment Sampling Letter Report, Shieldalloy Metallurgical Corporation, Newfield, New Jersey, TRC Environmental Corporation, May 1996.

TRC, 1999. Lagoon Closure Report, Shieldalloy Metallurgical Corporation, Newfield, New Jersey, TRC Environmental Corporation, December 1999.

TRC, 2000. Supplemental Soil Sampling Report, Former Lagoon B11, Shieldalloy Metallurgical Corporation, Newfield, New Jersey, TRC Environmental Corporation, October 2000.

TRC, 2001a. Final Supplemental Soil Sampling Report, Former Lagoons B6, B7 and B8, Shieldalloy Metallurgical Corporation, Newfield, New Jersey, TRC Environmental Corporation, February 2001.

TRC, 2001b. Final Supplemental Soil Sampling Report, Former Lagoons B1, B2, B3, B5, B11 and B12, Shieldalloy Metallurgical Corporation, Newfield, New Jersey, TRC Environmental Corporation, February 2001.

TRC, 2006. 2006 Sediment Sampling Work Plan, Shieldalloy Metallurgical Corporation, Newfield, New Jersey, TRC Environmental Corporation, August 2006.

TRC, 2008. Phase II Supplemental Offsite Ground Water Investigation Work Plan, Shieldalloy Metallurgical Corporation, Newfield, New Jersey, TRC Environmental Corporation, August 2008.

TRC, 2009. Supplemental Sediment Sampling Summary, Shieldalloy Metallurgical Corporation, Newfield, New Jersey, TRC Environmental Corporation, June 2009.

US Bankruptcy Court, 1997. Environmental Settlement Agreement (ESA) between SMC and USEPA/NJDEP. Incorporated into SMC's Plan of Reorganization Pursuant to Chapter 11 of the Bankruptcy Code, March 1997.

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8.0 PROJECT OVERVIEW AND SCHEDULE

This section provides a general overview of the activities that will be performed and how and when they will be performed based on Site background information, Site background data, and preplanning Site visits. A summary of these activities is presented on Worksheet #14, which follows. Specific details for individual project activities will be discussed in later sections of the QAPP. Additional details are presented in the companion RI and BERA Work Plans for this project.

8.1 Project Overview

The primary objectives of this RI are as follows:

- Define the nature and extent of contamination in soil, sediment and surface water;
- Develop a sufficient database to support the human health and ecological risk assessments;
- Address identified data gaps; and
- Collect sufficient data to support the revised Feasibility Study.

In addition the primary objectives of the BERA are as follows:

- To assess the bioavailability of the contaminants of potential ecological concern (COPECs);
- To develop an understanding of the relationship between the COPEC concentrations in the sediment and aquatic vegetation and aquatic invertebrates (i.e., bioaccumulation factors);
- To develop an understanding of the relationship between the COPEC concentrations in the surface soil and the terrestrial invertebrates (i.e., bioaccumulation factor); and
- To estimate COPEC exposure by the selected assessment endpoints (herbivorous and insectivorous birds and mammals).

Specific objectives are as follows:

1. Subsurface soil sampling will be conducted at the Former Manpro-Vibra Degreasing Unit in the Former Production Area in order to determine if a potential source of TCE contamination in groundwater exists in this area.

2. Surface and subsurface soil sampling will be conducted at Former Basins B9 and B10 in the Former Lagoons Area to provide data for risk assessments.

3. Surface soil sampling will be conducted north of the Eastern Storage Areas near the property line and along the southwestern property line of the Southern Area to delineate the horizontal extent of vanadium and hexavalent chromium exceeding risk standards.

4. Surface soil sampling will be conducted in the Former Thermal Pond Area in the Southern Area to delineate the horizontal extent of VOCs and metals exceeding risk standards.

5. Background soil samples will be collected in areas around the site that are not influenced by

releases for the risk assessment process.

6. Surface water samples will be collected along the Hudson Branch, in Burnt Mill Pond, and downstream of Burnt Mill Pond (Burnt Mill Branch) in order to evaluate the current water quality conditions.

7. Surface water and sediment samples will be collected upstream of Burnt Mill Pond in order to evaluate background surface water conditions.

8. Sediment samples will be collected from the Hudson Branch, Burnt Mill Pond, and Burnt Mill Branch in order to evaluate current sediment quality conditions.

9. Sediment samples will be collected from the on-site impoundment that discharges into the Hudson Branch to provide data for risk assessments.

10. Terrestrial invertebrate, aquatic invertebrate, aquatic vegetation, sediment and surface soil samples will be collected across a gradient of COPEC concentrations in order to develop site-specific plant: soil and invertebrate:soil bioaccumulation factors. Earthworms may be collected in lieu of terrestrial invertebrates; refer to Section 9.2.4 of this QAPP.

These objectives will be satisfied by the sampling and analysis program outlined in Worksheets #20-1 through 20-5 and 30.

8.1.1 Sampling Tasks

The sampling tasks are discussed in detail in the companion Work Plans and Section 9.0. The project calls for the sampling of soil, sediment, surface water, terrestrial invertebrates, aquatic invertebrates, and aquatic vegetation. This QAPP further defines the technical approach and provides the anticipated schedule of activities for this assignment. Sampling methods, sampling QC, sample handling and custody are discussed in other sections of this QAPP. Refer to Worksheets #20-1 through 20-5 for a summary of field and quality control samples which will be collected.

8.1.2 Analytical Tasks

The COCs and other target analytes have been identified based on the historical data. Worksheets #15-1 through 15-15 summarize the COCs, other target analytes, and project action limits for the program. Worksheet #30 summarizes the analytical parameters associated with each analysis, the concentration level and turnaround time required.

The goal of this investigation will be to obtain data of the highest quality for all matrices and to try and achieve the necessary risk standards. The achievement of the necessary risk standards is dependent on the limitations of the individual analytical methodologies and is discussed in more detail in Section 6.1.

All analyses listed above will be performed by a fixed laboratory. The data produced from these analyses will be used for definitive purposes. Field analyses during this investigation will include flame ionization detector (FID)/photoionization detector (PID) screening for soil headspace readings and water quality parameters for surface water.

8.2 Project Schedule

An overview of the proposed schedule is shown in Worksheet #16. A detailed project schedule is presented in the companion Work Plan.

QAPP Worksheet #14

Summary of Project Tasks

Sampling Tasks: See Section 8.1.1. For a complete discussion, refer to Section 9.0.

Analysis Tasks: See Section 8.1.2. For a complete discussion, refer to Section 10.

Quality Control Tasks: For a complete discussion, refer to Section 12.

Secondary Data: For a complete discussion, refer to Section 7.

Data Management Tasks: For a complete discussion, refer to Section 13.

Documentation and Records: For a complete discussion, refer to Section 13.

Data Packages: For a complete discussion, refer to Section 13.

Assessment/Audit Tasks: One laboratory audit and one or more field audits may be scheduled for this investigation. Audits will be performed as described in Section 14.

Data Verification and Validation Tasks: Data will undergo a validation in accordance with Region 2 data validation and/or EPA National Functional Guidelines, as appropriate. For a complete discussion, refer to Section 16.

Data Usability Assessment Tasks: Each of the Project Quality Objectives listed in Worksheets #12-1 through 12-12 will be examined to determine if the objective was met. The examination will include a review of both laboratory and field data. Each analysis will be evaluated separately in terms of the major impacts observed from the Data Validation, Data Quality Indicators (PARCCS), and measurement performance criteria assessments. For a complete discussion, refer to Section 17.

QAPP Worksheet #15-1

Matrix: *Sediment*
Analytical Group: *Semivolatiles*
Concentration Level: *Low*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) µg/Kg			Project Quantitation Limit µg/Kg	Achievable Laboratory Limits	
		1	2	3		MDLs µg/kg	QLs µg/kg
Benzaldehyde	100-52-7	NS	NS	10,000,000	140	6.6	140
Phenol*	108-95-2	NS	420	18,000,000	57	30	57
bis(2-Chloroethyl) ether	111-44-4	NS	NS	1000	57	8.6	57
2-Chlorophenol	95-57-8	NS	**31.2**	510,000	140	29	140
2-Methylphenol	95-48-7	NS	NS	3,100,000	57	33	57
2-2'-oxybis(1-Chloropropane)	108-60-1	NS	NS	22,000	57	8.5	57
Acetophenone	98-86-2	NS	NS	10,000,000	140	5.0	140
4-Methylphenol	106-44-5	NS	670	310,000	57	36	57
N-Nitroso-di-n-propylamine	621-64-7	NS	NS	250	57	7.0	57
Hexachloroethane	67-72-1	NS	1027	120,000	140	7.9	140
Nitrobenzene	98-95-3	NS	NS	24,000	57	8.3	57
Isophorone	78-59-1	NS	NS	1,800,000	57	7.7	57
2-Nitrophenol	88-75-5	NS	NS	NS	140	30	140
2,4-Dimethylphenol	105-67-9	NS	**29**	1,200,000	140	48	140
bis(2-Chloroethoxy)methane	111-91-1	NS	NS	180,000	57	12	57
2,4-Dichlorophenol	120-83-2	NS	**117**	180,000	140	46	140
Naphthalene*	91-20-3	160	176	18,000	29	7.8	29
4-Chloroaniline	106-47-8	NS	NS	8600	140	9.1	140
Hexachlorobutadiene	87-68-3	NS	NS	22,000	29	7.9	29
Caprolactam	105-60-2	NS	NS	31,000,000	57	9.0	57
4-Chloro-3-Methylphenol	59-50-7	NS	NS	6,200,000	140	29	140
2-Methylnaphthalene*	91-57-6	70	202	410,000	57	16	57
Hexachlorocyclopentadiene	77-47-4	NS	NS	370,000	570	29	570
2,4,6-Trichlorophenol	88-06-2	NS	213	160,000	140	27	140

QAPP Worksheet #15-1

Matrix: *Sediment*
Analytical Group: *Semivolatiles*
Concentration Level: *Low*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) µg/Kg			Project Quantitation Limit µg/Kg	Achievable Laboratory Limits	
		1	2	3		MDLs µg/kg	QLs µg/kg
2,4,5-Trichlorophenol	95-95-4	NS	NS	6,200,000	140	33	140
1,1'-Biphenyl	92-52-4	NS	1220	21,000	57	3.3	57
2-Chloronaphthalene	91-58-7	NS	NS	8,200,000	57	8.9	57
2-Nitroaniline	88-74-4	NS	NS	600,000	140	13	140
Dimethylphthalate	131-11-3	NS	NS	NS	57	10	57
Acenaphthylene*	208-96-8	**5.87**	**5.9**	NS	29	9.1	29
2,6-Dinitrotoluene	606-20-2	NS	NS	62,000	57	11	57
3-Nitroaniline	99-09-2	NS	NS	NS	140	11	140
Acenaphthene*	83-32-9	**6.71**	**6.7**	3,300,000	29	8.3	29
2,4-Dinitrophenol	51-28-5	NS	NS	120,000	570	35	570
4-Nitrophenol	100-02-7	NS	NS	NS	290	48	290
Dibenzofuran	132-64-9	NS	415	NS	57	8.5	57
2,4-Dinitrotoluene	121-14-2	NS	**41.6**	5500	57	12	57
Diethylphthalate	84-66-2	NS	603	49,000,000	57	9.7	57
Fluorene*	86-73-7	190	774	2,200,000	29	9.4	29
4-Chlorophenyl-phenylether	7005-72-3	NS	NS	NS	57	8.6	57
4-Nitroaniline	100-01-6	NS	NS	86,000	140	11	140
4,6-Dinitro-2-Methylphenol	534-52-1	NS	NS	4900	570	35	570
N-nitrosodiphenylamine	86-30-6	NS	2680	350,000	140	17	140
4-Bromophenyl-phenylether	101-55-3	NS	1230	NS	57	10	57
1,2,4,5-Tetrachlorobenzene	95-94-3	NS	1090	18,000	140	8.8	140
Hexachlorobenzene	118-74-1	**20**	**20**	1100	57	9.3	57
Atrazine	1912-24-9	NS	**6.62**	7500	140	5.6	140
Pentachlorophenol*	87-86-5	NS	504	2700	290	49	290

QAPP Worksheet #15-1

Matrix: *Sediment*
Analytical Group: *Semivolatiles*
Concentration Level: *Low*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) µg/Kg			Project Quantitation Limit µg/Kg	Achievable Laboratory Limits	
		1	2	3		MDLs µg/kg	QLs µg/kg
Phenanthrene*	85-01-8	NS	204	NS	29	13	29
Anthracene*	120-12-7	57.2	57.2	17,000,000	29	10	29
Carbazole	86-74-8	NS	NS	NS	57	13	57
Di-n-butylphthalate	84-74-2	NS	6470	6,200,000	57	6.3	57
Fluoranthene*	206-44-0	750	423	2,200,000	29	13	29
Pyrene*	129-00-0	490	195	1,700,000	29	11	29
Butylbenzylphthalate	85-68-7	NS	10,900	910,000	57	17	57
3,3'-Dichlorobenzidine	91-94-1	NS	**127**	3800	140	7.3	140
Benzo(a)anthracene*	56-55-3	320	108	2100	29	9.3	29
Chrysene*	218-01-9	340	166	210,000	29	9.7	29
Bis(2-Ethylhexyl) phthalate*	117-81-7	NS	180	120,000	57	25	57
Di-n-octylphthalate	117-84-0	NS	NS	NS	57	14	57
Benzo(b)fluoranthene*	205-99-2	NS	**27.2**	2100	29	9.5	29
Benzo(k)fluoranthene*	207-08-9	240	240	21,000	29	11	29
Benzo(a)pyrene*	50-32-8	370	150	210	29	8.7	29
Indeno(1,2,3-cd)pyrene*	193-39-5	200	**17**	2100	29	9.9	29
Dibenz(a,h)anthracene*	53-70-3	60	33	210	29	9.7	29
Benzo(g,h,i)perylene*	191-24-2	170	170	NS	29	11	29
2,3,4,6-Tetrachlorophenol	58-90-2	NS	284	1,800,000	140	29	140
Total PAHs	NA	4000	1610	NS	330	NA	330

* – Contaminant of Concern
1 – NJDEP Ecological Screening Criteria, Sediment, Freshwater Criteria, Lowest Effects Levels, 3/10/09.
2 – USEPA, 2006. EPA Region III BTAG, Freshwater Sediment Screening Benchmarks, August 2006.
3 – EPA Regional Screening Levels for Industrial Soil, June 2011. Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
Bold highlighted cells indicate project action limit will not be achieved.
NS – None specified.
NA – Not applicable.

QAPP Worksheet #15-2

Matrix: *Sediment*
Analytical Group: *Pesticides*
Concentration Level: *Low*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) µg/kg			Project Quantitation Limit µg/kg	Achievable Laboratory Limits	
		1	2	3		MDLs µg/kg	QLs µg/kg
alpha-BHC	319-84-6	6	3	270	1.2	0.36	1.2
beta-BHC	319-85-7	5	3	960	1.2	0.57	1.2
delta-BHC	319-86-8	NS	3	NS	1.2	0.32	1.2
gamma-BHC (Lindane)	58-89-9	3	3	2100	1.2	0.36	1.2
Heptachlor	76-44-8	NS	68	380	1.2	0.53	1.2
Aldrin	309-00-2	2	2	110	1.2	0.53	1.2
Heptachlor epoxide	1024-57-3	5	2.47	190	1.2	0.45	1.2
Endosulfan I	959-98-8	NS	2.9	370,000[a]	1.2	0.40	1.2
Dieldrin	60-57-1	2	1.9	110	1.2	0.40	1.2
4,4'-DDE*	72-55-9	5	3.16	5100	1.2	0.41	1.2
Endrin	72-20-8	3	2.22	18,000	1.2	0.41	1.2
Endosulfan II	33213-65-9	NS	14	370,000[a]	1.2	0.45	1.2
4,4'-DDD*	72-54-8	8	4.88	7200	1.2	0.51	1.2
Endosulfan Sulfate	1031-07-8	NS	5.4	NS	1.2	0.45	1.2
4,4'-DDT*	50-29-3	7	4.16	7000	1.2	0.49	1.2

QAPP Worksheet #15-2

Matrix: *Sediment*
Analytical Group: *Pesticides*
Concentration Level: *Low*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) µg/kg			Project Quantitation Limit µg/kg	Achievable Laboratory Limits	
		1	2	3		MDLs µg/kg	QLs µg/kg
Methoxychlor	72-43-5	NS	18.7	310,000	1.2	0.53	1.2
Endrin ketone	53494-70-5	NS	NS	NS	1.2	0.42	1.2
Endrin aldehyde	7421-93-4	NS	NS	NS	1.2	0.55	1.2
alpha-chlordane	5103-71-9	7[b]	3.24[b]	6500[b]	1.2	0.40	1.2
gamma-chlordane	5103-74-2	7[b]	3.24[b]	6500[b]	1.2	0.46	1.2
Toxaphene	8001-35-2	NS	**0.1**	1600	15	14	15

* – Contaminant of Concern
1 – NJDEP Ecological Screening Criteria, Sediment, Freshwater Criteria, Lowest Effects Levels, 3/10/09.
2 – USEPA, 2006. EPA Region III BTAG, Freshwater Sediment Screening Benchmarks, August 2006.
3 – EPA Regional Screening Levels for Industrial Soil, June 2011. Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
[a] – Used standard for endosulfan.
[b] – Used standard for Technical Chlordane
NS – None specified.
.

QAPP Worksheet #15-3

Matrix: *Sediment*
Analytical Group: *PCB Aroclors*
Concentration Level: *Low*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) µg/kg			Project Quantitation Limit µg/kg	Achievable Laboratory Limits	
		1	2	3		MDLs µg/kg	QLs µg/kg
Aroclor 1016	12674-11-2	**7**	NS	21,000	30	11	30
Aroclor 1221	11104-28-2	70[a]	NS	540	30	20	30
Aroclor 1232	11141-16-5	70[a]	NS	540	30	9.5	30
Aroclor 1242	53469-21-9	70[a]	NS	740	30	11	30
Aroclor 1248*	12672-29-6	30	NS	740	30	5.9	30
Aroclor 1254*	11097-69-1	60	NS	740	30	7.4	30
Aroclor 1260*	11096-82-5	**5**	NS	740	30	11	30
Total PCBs	NA	70	59.8	NS	30	NA	30

*Contaminant of Concern
1 – NJDEP Ecological Screening Criteria, Sediment, Freshwater Criteria, Lowest Effects Levels, 3/10/09.
2 – USEPA, 2006. EPA Region III BTAG, Freshwater Sediment Screening Benchmarks, August 2006.
3 – EPA Regional Screening Levels for Industrial Soil, June 2011. Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
[a]Used standard for total PCBs
Bold highlighted cells indicate project action limit will not be achieved.
NA – Not applicable
NS – None specified

QAPP Worksheet #15-4

Matrix: *Sediment*
Analytical Group: *Metals*
Concentration Level: *Low*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) mg/kg			Project Quantitation Limit mg/kg	Achievable Laboratory Limits	
		1	2	3		MDLs mg/kg	QLs mg/kg
Aluminum*	7429-90-5	NS	NS	99,000	20	0.743	20
Antimony*	7440-36-0	NS	2	41	2	0.125	2
Arsenic*	7440-38-2	6	9.8	**1.6**	2	0.275	2
Barium	7440-39-3	NS	NS	19,000	20	0.136	20
Beryllium	7440-41-7	NS	NS	200	0.2	0.015	0.2
Cadmium*	7440-43-9	0.6	0.99	80	0.5	0.034	0.5
Calcium	7440-70-2	NS	NS	NS	500	1.004	500
Chromium*	7440-47-3	26	43.4	150,000	1	0.062	1
Cobalt	7440-48-4	NS	50	30	5	0.031	5
Copper*	7440-50-8	16	31.6	4100	2.5	0.108	2.5
Iron	7439-89-6	NS	20,000	72,000	10	1.124	10
Lead*	7439-92-1	31	35.8	80	2	0.110	2
Magnesium	7439-95-4	NS	NS	NS	500	3.544	500
Manganese*	7439-96-5	NS	460	2300	1.5	0.031	1.5
Mercury*	7439-97-6	0.2	0.18	4.3	0.084	0.0098	0.084
Nickel*	7440-02-0	16	22.7	2000	4	0.065	4
Potassium	7440-09-7	NS	NS	NS	1000	3.376	1000
Selenium*	7782-49-2	NS	2	510	2	0.267	2
Silver	7440-22-4	1.0	1.0	510	0.5	0.069	0.5
Sodium	7440-23-5	NS	NS	NS	1000	1.482	1000
Thallium	7440-28-0	NS	NS	1.0	1	0.210	1

QAPP Worksheet #15-4

Matrix: *Sediment*
Analytical Group: *Metals*
Concentration Level: *Low*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) mg/kg			Project Quantitation Limit mg/kg	Achievable Laboratory Limits	
		1	2	3		MDLs mg/kg	QLs mg/kg
Vanadium*	7440-62-2	NS	NS	520	5	0.064	5
Zinc*	7440-66-6	120	121	31,000	2	0.475	2

* – Contaminant of Concern
1 – NJDEP Ecological Screening Criteria, Sediment, Freshwater Criteria, Lowest Effects Levels, 3/10/09.
2 – USEPA, 2006. EPA Region III BTAG, Freshwater Sediment Screening Benchmarks, August 2006.
3 – EPA Regional Screening Levels for Industrial Soil, June 2011. Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
Bold highlighted cells indicate project action limit will not be achieved.
NS – None Specified

QAPP Worksheet #15-5

Matrix: *Sediment*
Analytical Group: *TOC*
Concentration Level: *NA*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) mg/kg	Project Quantitation Limit mg/kg	Achievable Laboratory Limits	
				MDLs mg/kg	QLs mg/kg
TOC	NA	NA	1000	567	1000

NA – Not Applicable

QAPP Worksheet #15-6

Medium/Matrix: *Soil*
Analytical Group: *Volatiles*
Concentration Level: *High*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) µg/kg		Project Quantitation Limit µg/kg	Achievable Laboratory Limits	
		1	2		MDLs µg/kg	QLs µg/kg
Dichlorodifluoromethane	75-71-8	230,000,000	40,000	500	95	500
Chloromethane	74-87-3	12,000	50,000	500	17	500
Vinyl chloride	75-01-4	2000	1700	500	18	500
Bromomethane	74-83-9	59,000	3200	500	40	500
Chloroethane	75-00-3	NS	6,100,000	500	100	500
Trichlorofluoromethane	75-69-4	340,000,000	340,000	500	23	500
1,1-Dichloroethene	75-35-4	150,000	110,000	500	66	500
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	NS	18,000,000	500	56	500
Acetone	67-64-1	NS	63,000,000	1000	220	1000
Carbon disulfide	75-15-0	110,000,000	370,000	500	31	500
Methyl acetate	79-20-9	NS	100,000,000	500	82	500
Methylene chloride	75-09-2	97,000	53,000	500	22	500
trans-1,2-Dichloroethene	156-60-5	720,000	69,000	500	45	500
Methyl tert-butyl ether	1634-04-4	320,000	220,000	100	28	100
1,1-Dichloroethane	75-34-3	24,000	17,000	500	14	500
cis-1,2-Dichloroethene	156-59-2	560,000	200,000	500	24	500
2-Butanone (MEK)	78-93-3	44,000,000	20,000,000	1000	200	1000
Bromochloromethane	74-97-5	NS	68,000	500	22	500
Chloroform	67-66-3	2000	1500	500	32	500
1,1,1-Trichloroethane	71-55-6	4,200,000	3,800,000	500	13	500

QAPP Worksheet #15-6

Medium/Matrix: *Soil*
Analytical Group: *Volatiles*
Concentration Level: *High*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) µg/kg		Project Quantitation Limit µg/kg	Achievable Laboratory Limits	
		1	2		MDLs µg/kg	QLs µg/kg
Cyclohexane	110-82-7	NS	2,900,000	500	15	500
Carbon tetrachloride	56-23-5	2000	3000	500	56	500
Trichloroethene*	79-01-6	20,000	14,000	500	53	500
1,2-Dichloroethane	107-06-2	3000	2200	100	35	100
Benzene	71-43-2	5000	5400	100	34	100
Methyl cyclohexane	108-87-2	NS	NS	500	65	500
1,2 Dichloropropane	78-87-5	5000	4700	500	13	500
Bromodichloromethane	75-27-4	3000	1400	500	26	500
cis-1,3-Dichloropropene	10061-01-5	7000	8300	500	13	500
4-Methyl-2-pentanone	108-10-1	NS	5,300,000	500	81	500
Toluene	108-88-3	91,000,000	4,500,000	100	29	100
trans-1,3-Dichloropropene	10061-02-6	7000	8300	500	9.6	500
1,1,2-Trichloroethane	79-00-5	6000	5300	500	19	500
Tetrachloroethene	127-18-4	5000	2600	500	15	500
2-Hexanone	591-78-6	NS	140,000	500	96	500
Dibromochloromethane	124-48-1	8000	3300	500	11	500
Ethylene dibromide	106-93-4	**40**	170	100	14	100
Chlorobenzene	108-90-7	7,400,000	140,000	500	34	500
Ethylbenzene	100-41-4	110,000,000	27,000	100	37	100
Xylenes (total)	1330-20-7	170,000,000	270,000	200	47	200
Styrene	100-42-5	260,000	3,600,000	500	11	500

QAPP Worksheet #15-6

Medium/Matrix: *Soil*
Analytical Group: *Volatiles*
Concentration Level: *High*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) µg/kg		Project Quantitation Limit µg/kg	Achievable Laboratory Limits	
		1	2		MDLs µg/kg	QLs µg/kg
Bromoform	75-25-2	280,000	220,000	500	15	500
Isopropylbenzene	98-82-8	NS	1,100,000	500	52	500
1,1,2,2-Tetrachloroethane	79-34-5	3000	2800	500	29	500
1,3-Dichlorobenzene	541-73-1	59,000,000	NS	500	28	500
1,4-Dichlorobenzene	106-46-7	13,000	12,000	500	34	500
1,2-Dichlorobenzene	95-50-1	59,000,000	980,000	500	27	500
1,2-Dibromo-3-chloropropane	96-12-8	**200**	**69**	1000	54	1000
1,2,4-Trichlorobenzene	120-82-1	820,000	99,000	500	35	500
1,2,3-Trichlorobenzene	87-61-6	NS	49,000	500	59	500
1,4-Dioxane	123-91-1	NS	17,000	13,000	8600	13,000

* – Contaminant of Concern
[1] – Soil Remediation Standards, NJDEP, Non-Residential Direct Contact, 11/4/09.
[2] – EPA Regional Screening Levels for Industrial Soil, June 2011. Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
NS – None Specified
Bold/highlighted cells indicate project action limit will not be achieved.

QAPP Worksheet #15-7

Matrix: *Soil*
Analytical Group: *Semivolatiles*
Concentration Level: *Low*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) µg/kg		Project Quantitation Limit µg/kg	Achievable Laboratory Limits	
		1	2		MDLs µg/kg	QLs µg/kg
Benzaldehyde	100-52-7	68,000,000	10,000,000	140	6.6	140
Phenol*	108-95-2	210,000,000	18,000,000	57	30	57
bis(2-Chloroethyl) ether	111-44-4	2000	1000	57	8.6	57
2-Chlorophenol	95-57-8	2,200,000	510,000	140	29	140
2-Methylphenol	95-48-7	3,400,000	3,100,000	57	33	57
2-2'-oxybis(1-Chloropropane)	108-60-1	67,000	22,000	57	8.5	57
Acetophenone	98-86-2	5000	10,000,000	140	5.0	140
4-Methylphenol	106-44-5	340,000	310,000	57	36	57
N-Nitroso-di-n-propylamine	621-64-7	300	250	57	7.0	57
Hexachloroethane	67-72-1	140,000	120,000	140	7.9	140
Nitrobenzene	98-95-3	340,000	24,000	57	8.3	57
Isophorone	78-59-1	2,000,000	1,800,000	57	7.7	57
2-Nitrophenol	88-75-5	NS	NS	140	30	140
2,4-Dimethylphenol	105-67-9	14,000,000	1,200,000	140	48	140
bis(2-Chloroethoxy)methane	111-91-1	NS	180,000	57	12	57
2,4-Dichlorophenol	120-83-2	2,100,000	180,000	140	46	140
Naphthalene*	91-20-3	17,000	18,000	29	7.8	29
4-Chloroaniline	106-47-8	NS	8600	140	9.1	140
Hexachlorobutadiene	87-68-3	25,000	22,000	29	7.9	29
Caprolactam	105-60-2	340,000,000	31,000,000	57	9.0	57
4-Chloro-3-Methylphenol	59-50-7	NS	6,200,000	140	29	140
2-Methylnaphthalene*	91-57-6	2,400,000	410,000	57	16	57
Hexachlorocyclopentadiene	77-47-4	110,000	370,000	570	29	570

QAPP Worksheet #15-7

Matrix: *Soil*
Analytical Group: *Semivolatiles*
Concentration Level: *Low*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) µg/kg		Project Quantitation Limit µg/kg	Achievable Laboratory Limits	
		1	2		MDLs µg/kg	QLs µg/kg
2,4,6-Trichlorophenol	88-06-2	74,000	160,000	140	27	140
2,4,5-Trichlorophenol	95-95-4	68,000,000	6,200,000	140	33	140
1,1[1]-Biphenyl	92-52-4	34,000,000	21,000	57	3.3	57
2-Chloronaphthalene	91-58-7	NS	8,200,000	57	8.9	57
2-Nitroaniline	88-74-4	23,000,000	600,000	140	13	140
Dimethylphthalate	131-11-3	NS	NS	57	10	57
Acenaphthylene*	208-96-8	300,000,000	NS	29	9.1	29
2,6-Dinitrotoluene	606-20-2	3000	62,000	57	11	57
3-Nitroaniline	99-09-2	NS	NS	140	11	140
Acenaphthene*	83-32-9	37,000,000	3,300,000	29	8.3	29
2,4-Dinitrophenol	51-28-5	1,400,000	120,000	570	35	570
4-Nitrophenol	100-02-7	NS	NS	290	48	290
Dibenzofuran	132-64-9	NS	NS	57	8.5	57
2,4-Dinitrotoluene	121-14-2	3000	5500	57	12	57
Diethylphthalate	84-66-2	550,000,000	49,000,000	57	9.7	57
Fluorene*	86-73-7	24,000,000	2,200,000	29	9.4	29
4-Chlorophenyl-phenylether	7005-72-3	NS	NS	57	8.6	57
4-Nitroaniline	100-01-6	NS	86,000	140	11	140
4,6-Dinitro-2-Methylphenol	534-52-1	68,000	4900	570	35	570
N-nitrosodiphenylamine	86-30-6	390,000	350,000	140	17	140
4-Bromophenyl-phenylether	101-55-3	NS	NS	57	10	57
1,2,4,5-Tetrachlorobenzene	95-94-3	NS	18,000	140	8.8	140
Hexachlorobenzene	118-74-1	1000	1100	57	9.3	57
Atrazine	1912-24-9	2,400,000	7500	140	5.6	140

QAPP Worksheet #15-7

Matrix: *Soil*
Analytical Group: *Semivolatiles*
Concentration Level: *Low*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) µg/kg		Project Quantitation Limit µg/kg	Achievable Laboratory Limits	
		1	2		MDLs µg/kg	QLs µg/kg
Pentachlorophenol*	87-86-5	10,000	2700	290	49	290
Phenanthrene*	85-01-8	300,000,000	NS	29	13	29
Anthracene*	120-12-7	30,000,000	17,000,000	29	10	29
Carbazole	86-74-8	96,000	NS	57	13	57
Di-n-butylphthalate	84-74-2	68,000,000	6,200,000	57	6.3	57
Fluoranthene**	206-44-0	24,000,000	2,200,000	29	13	29
Pyrene*	129-00-0	18,000,000	1,700,000	29	11	29
Butylbenzylphthalate	85-68-7	14,000,000	910,000	57	17	57
3,3'-Dichlorobenzidine	91-94-1	4000	3800	140	7.3	140
Benzo(a)anthracene*	56-55-3	2000	2100	29	9.3	29
Chrysene*	218-01-9	230,000	210,000	29	9.7	29
Bis(2-Ethylhexyl) phthalate*	117-81-7	140,000	120,000	57	25	57
Di-n-octylphthalate	117-84-0	27,000,000	NS	57	14	57
Benzo(b)fluoranthene*	205-99-2	2000	2100	29	9.5	29
Benzo(k)fluoranthene*	207-08-9	23,000	21,000	29	11	29
Benzo(a)pyrene*	50-32-8	200	210	29	8.7	29
Indeno(1,2,3-cd)pyrene*	193-39-5	2000	2100	29	9.9	29
Dibenz(a,h)anthracene*	53-70-3	200	210	29	9.7	29
Benzo(g,h,i)perylene*	191-24-2	30,000,000	NS	29	11	29
2,3,4,6-Tetrachlorophenol	58-90-2	NS	1,800,000	140	29	140

* – Contaminant of Concern
[1] – Soil Remediation Standards, NJDEP, Non-Residential Direct Contact, 11/4/09.
[2] – EPA Regional Screening Levels for Industrial Soil, June 2011. Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
NS – None specified.

QAPP Worksheet #15-8

Matrix: *Soil*
Analytical Group: *Pesticides*
Concentration Level: *Low*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) µg/kg		Project Quantitation Limit µg/kg	Achievable Laboratory Limits	
		1	2		MDLs µg/kg	QLs µg/kg
alpha-BHC	319-84-6	500	270	1.2	0.36	1.2
beta-BHC	319-85-7	2000	960	1.2	0.57	1.2
delta-BHC	319-86-8	NS	NS	1.2	0.32	1.2
gamma-BHC (Lindane)	58-89-9	2000	2100	1.2	0.36	1.2
Heptachlor	76-44-8	700	380	1.2	0.53	1.2
Aldrin	309-00-2	200	110	1.2	0.53	1.2
Heptachlor epoxide	1024-57-3	300	190	1.2	0.45	1.2
Endosulfan I	959-98-8	6,800,000	370,000[a]	1.2	0.40	1.2
Dieldrin	60-57-1	200	110	1.2	0.40	1.2
4,4'-DDE*	72-55-9	9000	5100	1.2	0.41	1.2
Endrin	72-20-8	340,000	18,000	1.2	0.41	1.2
Endosulfan II	33213-65-9	6,800,000	370,000[a]	1.2	0.45	1.2
4,4'-DDD*	72-54-8	13,000	7200	1.2	0.51	1.2
Endosulfan Sulfate	1031-07-8	6,800,000	NS	1.2	0.45	1.2
4,4'-DDT*	50-29-3	8000	7000	1.2	0.49	1.2
Methoxychlor	72-43-5	5,700,000	310,000	1.2	0.53	1.2

QAPP Worksheet #15-8

Matrix: *Soil*
Analytical Group: *Pesticides*
Concentration Level: *Low*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) µg/kg		Project Quantitation Limit µg/kg	Achievable Laboratory Limits	
		1	2		MDLs µg/kg	QLs µg/kg
Endrin ketone	53494-70-5	NS	NS	1.2	0.42	1.2
Endrin aldehyde	7421-93-4	NS	NS	1.2	0.55	1.2
alpha-chlordane	5103-71-9	1000	6500[b]	1.2	0.40	1.2
gamma-chlordane	5103-74-2	1000	6500[b]	1.2	0.46	1.2
Toxaphene	8001-35-2	3000	1600	15	14	15

* – Contaminant of Concern
[1] – Soil Remediation Standards, NJDEP, Non-Residential Direct Contact, 11/4/09.
[2] – EPA Regional Screening Levels for Industrial Soil, June 2011. Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
[a] – Used standard for Endosulfan.
[b] – Used standard for Technical Chlordane.
NS – None specified.

QAPP Worksheet #15-9

Medium/Matrix: *Soil*
Analytical Group: *PCB Aroclors*
Concentration Level: *Low*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) µg/kg		Project Quantitation Limit µg/kg	Achievable Laboratory Limits	
		1	2		MDLs µg/kg	QLs µg/kg
Aroclor 1016	12674-11-2	NS	21,000	30	11	30
Aroclor 1221	11104-28-2	NS	540	30	20	30
Aroclor 1232	11141-16-5	NS	540	30	9.5	30
Aroclor 1242	53469-21-9	NS	740	30	11	30
Aroclor 1248*	12672-29-6	NS	740	30	5.9	30
Aroclor 1254*	11097-69-1	NS	740	30	7.4	30
Aroclor 1260*	11096-82-5	1000	740	30	11	30

*Contaminant of Concern
[1] – Soil Remediation Standards, NJDEP, Non-Residential Direct Contact, 11/4/09.
[2] – EPA Regional Screening Levels for Industrial Soil, June 2011. Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
NS – None Specified

QAPP Worksheet #15-10

Matrix: *Soil*
Analytical Group: *Metals*
Concentration Level: *Low*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) mg/kg		Project Quantitation Limit mg/kg	Achievable Laboratory Limits	
		1	2		MDLs mg/kg	QLs mg/kg
Aluminum	7429-90-5	NS	99,000	20	0.743	20
Antimony	7440-36-0	450	41	2	0.125	2
Arsenic	7440-38-2	19	**1.6**	2	0.275	2
Barium	7440-39-3	59,000	19,000	20	0.136	20
Beryllium	7440-41-7	140	200	0.2	0.015	0.2
Cadmium	7440-43-9	78	80	0.5	0.034	0.5
Calcium	7440-70-2	NS	NS	500	1.004	500
Chromium	7440-47-3	NS	150,000	1	0.062	1
Cobalt	7440-48-4	590	30	5	0.031	5
Copper	7440-50-8	45,000	4100	2.5	0.108	2.5
Iron	7439-89-6	NS	72,000	10	1.124	10
Lead	7439-92-1	800	80	2	0.110	2
Magnesium	7439-95-4	NS	NS	500	3.544	500
Manganese	7439-96-5	5900	2300	1.5	0.031	1.5
Mercury	7439-97-6	65	4.3	0.084	0.0098	0.084

QAPP Worksheet #15-10

Matrix: *Soil*
Analytical Group: *Metals*
Concentration Level: *Low*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) mg/kg		Project Quantitation Limit mg/kg	Achievable Laboratory Limits	
		1	2		MDLs mg/kg	QLs mg/kg
Nickel	7440-02-0	23,000	2000	4	0.065	4
Potassium	7440-09-7	NS	NS	1000	3.376	1000
Selenium	7782-49-2	5700	510	2	0.267	2
Silver	7440-22-4	5700	510	0.5	0.069	0.5
Sodium	7440-23-5	NS	NS	1000	1.482	1000
Thallium	7440-28-0	79	1.0	1	0.210	1
Vanadium*	7440-62-2	1100	520	5	0.064	5
Zinc	7440-66-6	110,000	2300	2	0.475	2

*– Contaminant of Concern
[1] – Soil Remediation Standards, NJDEP, Non-Residential Direct Contact, 11/4/09.
[2] – EPA Regional Screening Levels for Industrial Soil, June 2011. Concentrations based on non-carcinogenic health effects are adjusted using HQ=0.1.
Bold highlighted cells indicate project action limit will not be achieved.
NS – None Specified

QAPP Worksheet #15-11

Matrix: *Soil*
Analytical Group: *Hexavalent Chromium*
Concentration Level: *Low*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) mg/kg		Project Quantitation Limit mg/kg	Achievable Laboratory Limits	
		1	2		MDLs mg/kg	QLs mg/kg
Hexavalent Chromium*	18540-29-9	20	5.6	4	0.220	4

*– Contaminant of Concern
[1] – Soil Remediation Standards, NJDEP, Non-Residential Direct Contact, 11/4/09.
[2] – EPA Regional Screening Levels for Industrial Soil, June 2011.

QAPP Worksheet #15-12

Matrix: *Surface Water*
Analytical Group: *Volatiles*
Concentration Level: *Low*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) µg/L				Project Quantitation Limit µg/L	Achievable Laboratory Limits	
		1		2	3		MDLs µg/L	QLs µg/L
		a	b					
Dichlorodifluoromethane	75-71-8	NS	NS	NS	NS	5.0	0.92	5.0
Chloromethane	74-87-3	NS	NS	NS	NS	1.0	0.29	1.0
Vinyl chloride	75-01-4	930	**0.082**	NS	930	1.0	0.44	1.0
Bromomethane	74-83-9	16	47	NS	NS	2.0	0.30	2.0
Chloroethane	75-00-3	NS	NS	NS	NS	1.0	0.37	1.0
Trichlorofluoromethane	75-69-4	NS	NS	NS	NS	5.0	0.54	5.0
1,1-Dichloroethene	75-35-4	65	4.7	NS	25	1.0	0.40	1.0
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	NS	NS	NS	NS	5.0	0.38	5.0
Acetone	67-64-1	NS	NS	NS	1500	10	2.9	10
Carbon disulfide	75-15-0	NS	NS	NS	**0.92**	2.0	0.74	2.0
Methyl acetate	79-20-9	NS	NS	NS	NS	5.0	1.5	5.0
Methylene chloride	75-09-2	940	2.5	NS	98.1	2.0	0.30	2.0
trans-1,2-Dichloroethene	156-60-5	970	590	NS	970	1.0	0.25	1.0
Methyl tert-butyl ether	1634-04-4	51,000	70	NS	11,070	1.0	0.23	1.0
1,1-Dichloroethane	75-34-3	NS	NS	NS	47	1.0	0.29	1.0
cis-1,2-Dichloroethene	156-59-2	NS	NS	NS	590[c]	1.0	0.22	1.0
2-Butanone (MEK)	78-93-3	NS	NS	NS	14,000	10	1.6	10
Bromochloromethane	74-97-5	NS	NS	NS	NS	5.0	0.33	5.0
Chloroform	67-66-3	140	68	NS	1.8	1.0	0.23	1.0
1,1,1-Trichloroethane	71-55-6	76	120	NS	11	1.0	0.26	1.0
Cyclohexane	110-82-7	NS	NS	NS	NS	5.0	1.9	5.0

QAPP Worksheet #15-12

Matrix: *Surface Water*
Analytical Group: *Volatiles*
Concentration Level: *Low*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) µg/L				Project Quantitation Limit µg/L	Achievable Laboratory Limits	
		1		2	3		MDLs µg/L	QLs µg/L
		a	b					
Carbon tetrachloride	56-23-5	240	**0.33**	NS	13.3	1.0	0.26	1.0
Trichloroethene*	79-01-6	47	1.0	NS	21	1.0	0.24	1.0
1,2-Dichloroethane	107-06-2	910	**0.29**	NS	100	1.0	0.33	1.0
Benzene	71-43-2	114	**0.150**	NS	370	1.0	0.23	1.0
Methyl cyclohexane	108-87-2	NS	NS	NS	NS	5.0	0.35	5.0
1,2 Dichloropropane	78-87-5	360	**0.50**	NS	NS	1.0	0.27	1.0
Bromodichloromethane	75-27-4	NS	**0.55**	NS	NS	1.0	0.22	1.0
cis-1,3-Dichloropropene	10061-01-5	NS	**0.34**	NS	**0.055**	1.0	0.25	1.0
4-Methyl-2-pentanone	108-10-1	NS	NS	NS	170	5.0	0.86	5.0
Toluene	108-88-3	253	1300	NS	2	1.0	0.30	1.0
trans-1,3-Dichloropropene	10061-02-6	NS	**0.34**	NS	**0.055**	1.0	0.21	1.0
1,1,2-Trichloroethane	79-00-5	500	13	NS	1200	1.0	0.23	1.0
Tetrachloroethene	127-18-4	45	**0.34**	NS	111	1.0	0.27	1.0
2-Hexanone	591-78-6	NS	NS	NS	99	5.0	1.4	5.0
Dibromochloromethane	124-48-1	NS	**0.40**	NS	NS	1.0	0.22	1.0
Ethylene dibromide	106-93-4	NS	NS	NS	NS	2.0	0.39	2.0
Chlorobenzene	108-90-7	47	210	NS	1.3	1.0	0.39	1.0
Ethylbenzene	100-41-4	14	530	NS	90	1.0	0.27	1.0
Xylenes (total)	1330-20-7	27	NS	NS	13	1.0	0.25	1.0
Styrene	100-42-5	32	NS	NS	72	5.0	0.58	5.0
Bromoform	75-25-2	230	4.3	NS	320	4.0	0.23	4.0
Isopropylbenzene	98-82-8	NS	NS	NS	2.6	2.0	0.57	2.0
1,1,2,2-Tetrachloroethane	79-34-5	380	4.7	NS	610	1.0	0.24	1.0

QAPP Worksheet #15-12

Matrix: *Surface Water*
Analytical Group: *Volatiles*
Concentration Level: *Low*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) µg/L				Project Quantitation Limit µg/L	Achievable Laboratory Limits	
		1		2	3		MDLs µg/L	QLs µg/L
		a	b					
1,3-Dichlorobenzene	541-73-1	38	2200	NS	150	1.0	0.25	1.0
1,4-Dichlorobenzene	106-46-7	9.4	550	NS	26	1.0	0.28	1.0
1,2-Dichlorobenzene	95-50-1	14	2000	NS	**0.7**	1.0	0.26	1.0
1,2-Dibromo-3-chloropropane	96-12-8	NS	NS	NS	NS	10	1.1	10
1,2,4-Trichlorobenzene	120-82-1	30	21	NS	24	5.0	056	5.0
1,2,3-Trichlorobenzene	87-61-6	NS	NS	NS	8	5.0	0.47	5.0
1,4-Dioxane	123-91-1	NS	NS	NS	NS	130	94	130

* – Contaminant of Concern
1 – NJDEP Ecological Screening Criteria, Surface Water, Freshwater Criteria, 3/10/09.
[a] – Aquatic/Chronic
[b] – Human Health
2 – USEPA National Recommended Water Quality Criteria, Freshwater CCC, Chronic Value, 2009.
3 – USEPA, 2006. EPA Region III BTAG, Freshwater Screening Benchmarks, July 2006.
[c]– Used standard for 1,2-Dichloroethene
NS – None Specified
Bold highlighted cells indicate project action limit will not be achieved.

QAPP Worksheet #15-13

Matrix: *Surface Water*
Analytical Group: *Metals (Total and Dissolved)*
Concentration Level: *Low*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) µg/L				Project Quantitation Limit µg/L	Achievable Laboratory Limits	
		1					MDLs µg/L	QLs µg/L
		a	b	2	3			
Aluminum	7429-90-5	NS	NS	**87**	**87**	200+	7.18	200
Antimony	7440-36-0	80	**5.6**	NS	30	6.0	1.25	6.0
Arsenic*	7440-38-2	150	**0.017**	150	**5**	8.0	0.92	8.0
Barium	7440-39-3	220	2000	NS	**4**	200	0.44	200
Beryllium	7440-41-7	3.6	6.0	NS	**0.66**	1.0	0.24	1.0
Cadmium	7440-43-9	NS	3.4	**0.25**	**0.25**	3.0+	0.17	3.0
Calcium	7440-70-2	NS	NS	NS	116,000	5000	8.97	5000
Chromium*	7440-47-3	42	92	74	11	10	0.90	10
Cobalt	7440-48-4	**24**	NS	NS	74	50+	0.30	50
Copper	7440-50-8	NS	1300	**9**[a]	**9**	10+	0.85	10
Iron*	7439-89-6	NS	NS	1000	300	100	7.73	100
Lead*	7439-92-1	5.4	5	**2.5**	**2.5**	3.0	0.94	3.0
Magnesium	7439-95-4	NS	NS	NS	82,000	5000	16.8	5000
Manganese	7439-96-5	NS	NS	NS	120	15	0.18	15
Mercury	7439-97-6	0.77	**0.050**	0.77	**0.026**	0.2	0.088	0.2
Nickel	7440-02-0	NS	500	52	52	10	0.41	10
Potassium	7440-09-7	NS	NS	NS	53,000	10,000	15.7	10,000
Selenium	7782-49-2	**5.0**	170	**5**	**1**	10+	1.46	10
Silver	7440-22-4	**0.12**	170	NS	**3.2**	10	0.72	10
Sodium	7440-23-5	NS	NS	NS	680,000	10,000	13.5	10,000
Thallium	7440-28-0	10	**0.24**	NS	**0.8**	10	1.70	10
Vanadium*	7440-62-2	**12**	NS	NS	**20**	50+	0.43	50

QAPP Worksheet #15-13

Matrix: *Surface Water*
Analytical Group: *Metals (Total and Dissolved)*
Concentration Level: *Low*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) µg/L				Project Quantitation Limit µg/L	Achievable Laboratory Limits	
		1		2	3		MDLs µg/L	QLs µg/L
		a	b					
Zinc	7440-66-6	NS	7400	120	120	20	4.52	20

* – Contaminant of Concern
1 – NJDEP Ecological Screening Criteria, Surface Water, Freshwater Criteria, 3/10/09.
[a] – Aquatic/Chronic
[b] – Human Health
2 – USEPA National Recommended Water Quality Criteria, Freshwater CCC, Chronic Value, 2009.
3 – USEPA, 2006. EPA Region III BTAG, Freshwater Screening Benchmarks, July 2006.
Bold highlighted cells indicate project action limit will not be achieved.
NS – None Specified
+Refer to Worksheet #15-13a for quantitation limits associated with the additional analysis to be performed for these metals (via ICP/MS) in order to achieve lower quantitation limits.

QAPP Worksheet #15-13a

Matrix: *Surface Water*
Analytical Group: *Metals (Total and Dissolved)*
***Concentration Level**: Low*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) µg/L				Project Quantitation Limit µg/L	Achievable Laboratory Limits	
		1		2	3		MDLs µg/L	QLs µg/L
		a	d					
Aluminum	7429-90-5	NS	NS	87	87	50	22	50
Cadmium	7440-43-9	NS	3.4	**0.25**	**0.25**	0.5	0.084	0.5
Cobalt	7440-48-4	24	NS	NS	74	0.2	0.023	0.2
Copper	7440-50-8	NS	1300	9	9	1	0.33	1
Selenium	7782-49-2	5.0	170	5	**1**	5	0.34	5
Vanadium*	7440-62-2	12	NS	NS	20	5	0.14	5

* – Contaminant of Concern
1 – NJDEP Ecological Screening Criteria, Surface Water, Freshwater Criteria, 3/10/09.
[a] – Aquatic/Chronic
[b] – Human Health
2 – USEPA National Recommended Water Quality Criteria, Freshwater CCC, Chronic Value, 2009.
3 – USEPA, 2006. EPA Region III BTAG, Freshwater Screening Benchmarks, July 2006.
Bold highlighted cells indicate project action limit will not be achieved.
NS – None Specified

QAPP Worksheet #15-14

Matrix: *Surface Water*
Analytical Group: *Hexavalent Chromium (total and dissolved)*
***Concentration Level**: Low*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL) µg/L				Project Quantitation Limit µg/L	Achievable Laboratory Limits	
		1		2	3		MDLs µg/L	QLs µg/L
		a	b					
Hexavalent Chromium*	18540-29-9	10	NS	11	11	5	3.2	5

* – Contaminant of Concern
1 – NJDEP Ecological Screening Criteria, Surface Water, Freshwater Criteria, 3/10/09.
[a] – Aquatic/Chronic
[b] – Human Health
2 – USEPA National Recommended Water Quality Criteria, Freshwater CCC, Chronic Value, 2009.
3 – USEPA, 2006. EPA Region III BTAG, Freshwater Screening Benchmarks, July 2006.
NS – None Specified

QAPP Worksheet #15-15

Matrix: *Tissue (terrestrial invertebrates, aquatic invertebrates, aquatic vegetation, earthworms)*
Analytical Group: *Metals*
Concentration Level: *Low*

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (PAL)	Project Quantitation Limit mg/kg	Achievable Laboratory Limits	
				MDLs mg/kg	QLs mg/kg
Antimony*	7440-36-0	NA	0.05	0.005	0.05
Barium*	7440-39-3	NA	0.05	0.007	0.05
Chromium*	7440-47-3	NA	0.05	0.011	0.05
Copper*	7440-50-8	NA	0.05	0.011	0.05
Mercury*	7439-97-6	NA	0.012	0.003	0.012
Vanadium*	7440-62-2	NA	0.5	0.011	0.5

Note: Aquatic invertebrates analyzed for all of above-listed metals; terrestrial invertebrates and earthworms analyzed only for chromium and vanadium; aquatic vegetation analyzed only for chromium.

* – Contaminant of Concern
NA – Not applicable; data used to generate bioaccumulation factors and not compared to project action limits.

QAPP Worksheet #16

Project Schedule/Timeline Table

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date[1]
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Work Plan/FSP/QAPP/HASP Preparation	TRC	3/7/11	5/27/11	RI Work Plan Documents	5/27/11
Work Plan/FSP/QAPP/HASP Approval	EPA	5/27/11	9/30/11	NA	NA
Site Preparation	TRC	10/3/11	10/13/11	NA	NA
Sampling Program	TRC	10/13/11	4/20/12	NA	NA
Laboratory Analyses	Accutest Laboratories Alpha Analytical Laboratory	4/20/12	5/21/12	NA	NA
Data Validation/Usability Assessment	TRC	6/4/12	8/2/12	NA	6/26/12
Site Characterization Summary Report Preparation	TRC	8/2/12	9/17/12	Site Characterization Summary Report	8/9/12
Pathway Analysis Report	TRC	12/28/12	4/12/13	Pathway Analysis Report	3/15/13
Baseline Human Health Risk Assessment (BHHRA)	TRC	5/27/11	6/13/13	BHHRA Report	6/13/13
Screening Level Ecological Risk Assessment (SLERA)	TRC	5/27/11	7/19/11	SLERA Report	7/19/11
Baseline Ecological Risk Assessment Scope of Work, Sampling and BERA Report (if required)	TRC	12/20/12	4/4/13	BERA Report	4/4/13
RI Report Preparation	TRC	12/21/12	8/22/13	RI Report	7/17/13

[1]Deliverable due date for all activities except Work Plan preparation reflects resubmission of document after receipt/incorporation of EPA comments on original submittal.
NA – Not Applicable

9.0 SAMPLING TASKS

The details of the sampling rationale and locations are presented in this section. Worksheet #17 provides details on the sampling design and rationale. Worksheets #18-1 through 18-7 and 19 provide details on the sample matrices, parameters, applicable sampling procedures, containers and preservation requirements, and holding times.

QAPP Worksheet #17

Sampling Design and Rationale

Describe and provide a rationale for choosing the sampling approach (e.g., grid system, biased statistical approach):

Soil Sampling/RI:

Soil samples will be collected from several areas of the Site to address data gaps. Soil sample locations on Site are provided in Figure 15 of the RI Work Plan. Background soil sample locations are provided in Figure 16 of the RI Work Plan.

The soil sampling rationale is provided in detail in Sections 2 and 3 of the RI Work Plan and is summarized below:

Area of Site	# of Planned Samples	Rationale for Sampling
Former Production Area (Manpro-Vibra Degreasing Unit)	≥ 5 subsurface soil for VOCs	To determine source of VOC contamination in groundwater in this area. Sample with highest PID/FID reading or greatest impact (i.e., staining or sheens) submitted for analysis. If evidence of contamination exists, additional sample 2 to 3 feet below the first sample will be collected for vertical delineation. If no evidence of contamination exists, the one sample will be collected from 0.5 feet above the water table. Additional horizontal or vertical borings may be required, depending on sample results.
Former Lagoons Area (Former Basins B9 and B10)	2 surface soil for VOCs, Cr^{+6}, pH, ORP, chromium and vanadium (0.5-1.0' for VOCs and 0-1' for other parameters) ≥ 2 subsurface soil for VOCs, Cr^{+6}, pH, ORP and vanadium	Limited post-closure data available at these locations. Surface soil sampling performed to confirm previous post lagoon closure sample results. Subsurface soil sample with highest PID/FID reading or greatest impact (i.e., staining or sheens) submitted for analysis. If evidence of contamination exists, additional subsurface sample 2 to 3 feet below the first sample will be collected for vertical delineation. If no evidence of contamination exists, the one subsurface soil sample will be collected from 0.5 feet above the water table.
Eastern Storage Areas (north of this area and near property line)	2 surface soil (0-1') for vanadium and pH 1 surface soil (0-1') for Cr^{+6}, pH, and ORP	To delineate horizontal extent of vanadium and hexavalent chromium in this area. If results exceed project action limits, additional step out samples may be collected to accomplish the horizontal delineation.
Southern Area (southwestern property line)	2 surface soil (0-1') for vanadium and pH	To delineate horizontal extent of vanadium in this area. If results exceed project action limits, additional step out samples may be collected to accomplish the horizontal delineation.

QAPP Worksheet #17

Sampling Design and Rationale

Area of Site	# of Planned Samples	Rationale for Sampling
Southern Area (Former Thermal Pond Area)	6 surface soil samples for VOCs, Cr^{+6}, pH, ORP and TAL metals (0.5-1.0' for VOCs and 0-1' for other parameters)	No previous soil investigations were conducted in this area. To delineate horizontal extent of VOCs and metals exceeding risk standards. If results exceed project action limits, additional step out samples may be collected to accomplish the horizontal delineation.
Background Soil	13 surface soil (0-1') for TAL metals, Cr^{+6}, pH, and ORP	To address the data gap and to develop sufficient database to support the Revised Risk Assessment.

See Worksheet # 18-1 for sampling location and method details.

Sediment Sampling/RI:

Sediment samples will be collected from the Hudson Branch, Burnt Mill Pond, Burnt Mill Branch and from the on-site impoundment that discharges into the Hudson Branch in order to evaluate current sediment conditions and to delineate the extent of sediment contamination in the Hudson Branch and Burnt Mill Pond. Sediment sample locations are provided in Figure 17 of the RI Work Plan.

Sediment samples will also be collected to evaluate background conditions. All sediment samples will be collected sequentially beginning at the most downstream location and ending with the upstream location to eliminate the potential for cross-contamination between sampling locations and to ensure sample quality.

The sediment sampling rationale is provided in detail in Sections 2 and 3 of the RI Work Plan and summarized below.

Sample Locations	# of Planned Samples	Rationale for Sampling
Hudson Branch (center of stream channel at transects on Hudson Branch) -4 transects just south of site -3 transects downstream of site	7 sediment samples (1.5-2') for TCL SVOCs, TCL Pesticides, TCL PCBs, TAL metals, TOC, particle grain size, and pH. 14 stream bank soil samples (0-1'; 2 per transect) for TCL SVOCs, TCL Pesticides, TCL PCBs, TAL metals, Cr^{+6} pH, and ORP.	To accomplish the vertical delineation and to evaluate current sediment quality conditions. Additional horizontal and/or vertical samples may be required, depending on sample results.
Sample Locations	**# of Planned Samples**	**Rationale for Sampling**
On-Site Impoundment (discharges into the Hudson Branch)	6 sediment samples (0-0.5') for TCL SVOCs, TCL Pesticides, TCL PCBs, TAL metals, TOC, particle grain size, and pH.	To evaluate sediment quality within the on-site impoundment.
Burnt Mill Pond	4 sediment samples (0-0.5') for TAL metals, TOC,	To accomplish the vertical delineation and to evaluate current

QAPP Worksheet #17

Sampling Design and Rationale

	particle grain size and pH	sediment quality conditions. Additional horizontal and/or vertical samples may be required, depending on sample results.
Burnt Mill Branch (downstream of Burnt Mill Pond)	2 sediment samples (0-0.5') for TAL metals, TOC, particle grain size and pH	To evaluate sediment conditions in Burnt Mill Branch, downstream of the Burnt Mill Pond. Additional horizontal and/or vertical samples may be required, depending on sample results.
Burnt Mill Branch (upstream of Burnt Mill Pond)	8 sediment samples (0-0.5') for TCL SVOCs, TCL Pesticides, TCL PCBs, TAL metals, TOC, particle grain size and pH.	To evaluate background sediment conditions.

See Worksheet # 18-2 for sampling location and method details.

Surface Water Sampling/RI:

Surface water samples will be collected from the Hudson Branch, Burnt Mill Pond and Burnt Mill Branch in order to evaluate current surface water quality conditions and to identify and delineate potential environmental impacts in these water bodies. Surface water sample locations are provided in Figure 17 of the RI Work Plan.

Surface water samples will also be collected to evaluate background conditions. All surface water samples will be collected sequentially beginning at the most downstream location and ending with the upstream location to eliminate the potential for cross-contamination between sampling locations and to ensure sample quality.

The surface water sampling rationale is provided in detail in Sections 2 and 3 of the RI Work Plan and is summarized below.

Sample Locations	# of Planned Samples	Rationale for Sampling
Hudson Branch (center of stream channel at transects on Hudson Branch) -4 transects just south of site -3 transects downstream of site	7 samples for TAL metals (total and dissolved), Cr^{+6} (total and dissolved), TCL VOCs, and hardness	To evaluate current water quality conditions.
Burnt Mill Pond	4 samples for TAL metals (total and dissolved), Cr^{+6} (total and dissolved), hardness, and TCL VOCs	To evaluate current water quality conditions. VOCs will be placed on hold at laboratory. If VOCs exceed project action levels in Hudson Branch surface water samples, analysis of these samples for VOCs will be authorized.

QAPP Worksheet #17

Sampling Design and Rationale

Sample Locations	# of Planned Samples	Rationale for Sampling
Burnt Mill Branch (downstream of Burnt Mill Pond)	2 samples for TAL metals (total and dissolved), Cr^{+6} (total and dissolved), and hardness	To determine if contaminants have migrated downstream.
Burnt Mill Branch (upstream of Burnt Mill Pond)	8 samples for TAL metals (total and dissolved), Cr^{+6} (total and dissolved), TCL VOCs, and hardness	To evaluate background surface water conditions.

See Worksheet # 18-2 for sampling location and method details.

Sediment, Surface Soil, Terrestrial Invertebrate, Aquatic Invertebrate, and Aquatic Vegetation Sampling for the BERA:

The screening-level ecological risk assessment concluded that sediment and/or surface soil concentrations of select metals warrant further evaluation to determine if there is a potential risk to insectivorous birds and mammals as well as herbivorous birds and mammals. These contaminants were retained as sediment and/or surface soil contaminants of potential ecological concern (COPECs) and recommended for further evaluation in a baseline ecological risk assessment. A field tissue residue study with terrestrial invertebrates, aquatic invertebrates, and aquatic vegetation is subsequently proposed to further evaluate the potential for these COPECs to adversely affect insectivorous and herbivorous birds and mammals. The purpose of the field tissue study is to assess the bioavailability of the COPECs by measuring COPEC concentrations in foods (vegetation and invertebrates) consumed by the assessment endpoints (insectivorous and herbivorous birds and mammals). Soil and sediment samples will be collected concurrently with the field tissue samples in order to develop an understanding of the relationship between the COPEC concentrations in the environmental medium and the organisms (i.e., bioaccumulation factor). Samples of terrestrial invertebrates, aquatic invertebrates, aquatic vegetation, sediment and surface soils will be collected across a gradient of COPEC concentrations (based on the previous surface soil and sediment sampling results) in order to develop site-specific plant:soil and invertebrate:soil bioaccumulation factors. These bioaccumulation factors will then be used in the baseline ecological risk assessment to estimate plant and invertebrate COPEC concentrations throughout the site and to estimate COPEC exposure by the selected assessment endpoints. It should be noted that earthworms may be collected in lieu of terrestrial invertebrates; refer to Section 9.2.4 of the QAPP for details. Refer to Figure C-1 in the BERA Work Plan for approximate sample locations.

See Worksheets # 18-3 through 18-7 for sampling location and method details.

QAPP Worksheet #18-1: RI Sampling: Soil

Matrix: Soil

Sampling Locations and Methods/SOP Requirements Table

Location	Sample ID	Depth Interval (inches)	Analytical Group	Concentration Level	Sample Collection Protocol[1]	Minimum # of Samples	Maximum # of Samples	Comment
Former Production Area (Manpro-Vibra Degreasing Unit)	SB-88	TBD	TCL VOCs	High	Samples will be collected from 0.5 feet interval with highest PID/FID reading or greatest impact. If no evidence of contamination exists, sample will be collected from 0.5 feet interval above the water table. If evidence of contamination exists, a contingency sample will be collected 2 to 3 feet below the first sample for vertical delineation.	1	2	Subsurface Soil Sample
	SB-89	TBD	TCL VOCs	High		1	2	Subsurface Soil Sample
	SB-90	TBD	TCL VOCs	High		1	2	Subsurface Soil Sample
	SB-91	TBD	TCL VOCs	High		1	2	Subsurface Soil Sample
	SB-92	TBD	TCL VOCs	High		1	2	Subsurface
Former Lagoons Area (Former Basins B9 and B10)	SB-93A	VOCs: 6-12 Other parameters: 0-12	TCL VOCs vanadium, chromium, hexavalent chromium, pH, ORP	VOCs: High Others: Low	Surface soil samples will be collected from exposed ground surface to 1 ft below ground.	1	1	Surface Soil Sample
	SB-94A	VOCs: 6-12 Other parameters: 0-12	TCL VOCs vanadium, chromium, hexavalent chromium, pH, ORP	VOCs: High Others: Low		1	1	Surface Soil Sample
	SB-93B	TBD	TCL VOCs vanadium, hexavalent chromium, pH, ORP	VOCs: High Others: Low	Subsurface soil samples will be collected from 0.5 feet interval with highest PID/FID	1	2	Subsurface Soil Sample

QAPP Worksheet #18-1: RI Sampling: Soil

Matrix: Soil

Sampling Locations and Methods/SOP Requirements Table

Location	Sample ID	Depth Interval (inches)	Analytical Group	Concentration Level	Sample Collection Protocol[1]	Minimum # of Samples	Maximum # of Samples	Comment
	SB-94B	TBD	TCL VOCs vanadium, hexavalent chromium, pH, ORP	VOCs: High Others: Low	reading or greatest impact. If no evidence of contamination exists, sample will be collected from 0.5 feet interval above the water table. If evidence of contamination exists, a contingency sample will be collected 2 to 3 feet below the first sample for vertical delineation.	1	2	Subsurface Soil Sample
Eastern Storage Areas	SB-95	0-12	hexavalent chromium, pH, ORP	Low	Surface soil samples will be collected from exposed ground surface to 1 ft below ground. If the surface soil sample results are above the EPA screening levels or NJDEP NRDCSRS, then the field team may be directed to step out and collect at least one sample to accomplish the horizontal delineation.	1	2	Surface Soil Sample
	SB-96	0-12	Vanadium, pH	Low		1	2	Surface Soil Sample
	SB-97	0-12	Vanadium, pH	Low		1	2	Surface Soil Sample

QAPP Worksheet #18-1: RI Sampling: Soil

Matrix: Soil

Sampling Locations and Methods/SOP Requirements Table

Location	Sample ID	Depth Interval (inches)	Analytical Group	Concentration Level	Sample Collection Protocol[1]	Minimum # of Samples	Maximum # of Samples	Comment
Southern Area (Former Thermal Pond Area)	SB-98	VOCs: 6-12 Other parameters: 0-12	TCL VOCs, TAL metals, hexavalent chromium, pH, ORP	VOCs: High Others: Low	Surface soil samples will be collected from exposed ground surface to 1 ft below ground. If the surface soil sample results are above the EPA screening levels or NJDEP NRDCSRS, then, the field team may be directed to step out and collect at least one sample to accomplish the horizontal delineation.	1	2	Surface Soil Sample
	SB-99	VOCs: 6-12 Other parameters: 0-12	TCL VOCs, TAL metals, hexavalent chromium, pH, ORP	VOCs: High Others: Low		1	2	Surface Soil Sample
	SB-100	VOCs: 6-12 Other parameters: 0-12	TCL VOCs TAL metals, hexavalent chromium, pH, ORP	VOCs: High Others: Low		1	2	Surface Soil Sample
	SB-101	VOCs: 6-12 Other parameters: 0-12	TCL VOCs TAL metals, hexavalent chromium, pH, ORP	VOCs: High Others: Low		1	2	Surface Soil Sample
	SB-102	VOCs: 6-12 Other parameters: 0-12	TCL VOCs TAL metals, hexavalent chromium, pH, ORP	VOCs: High Others: Low		1	2	Surface Soil Sample
	SB-103	VOCs: 6-12 Other parameters: 0-12	TCL VOCs TAL metals, hexavalent chromium, pH, ORP	VOCs: High Others: Low		1	2	Surface Soil Sample

QAPP Worksheet #18-1: RI Sampling: Soil

Matrix: Soil

Sampling Locations and Methods/SOP Requirements Table

Location	Sample ID	Depth Interval (inches)	Analytical Group	Concentration Level	Sample Collection Protocol[1]	Minimum # of Samples	Maximum # of Samples	Comment
Southern Area (Southwestern Property Line)	SB-104	0-12	Vanadium, pH	Low	Surface soil samples will be collected from exposed ground surface to 1 ft below ground. If the surface soil sample results are above the EPA screening levels or NJDEP NRDCSRS, then the field team may be directed to step out and collect at least one sample to accomplish the horizontal delineation.	1	2	Surface Soil Sample
	SB-105	0-12	Vanadium, pH	Low		1	2	Surface Soil Sample
Background Sampling	BG-1	0-12	TAL metals, hexavalent chromium, pH, ORP	Low	Surface soil samples will be collected from exposed ground surface to 1 ft below ground.	1	1	Surface Soil Sample
	BG-2	0-12	TAL metals, hexavalent chromium, pH, ORP	Low		1	1	Surface Soil Sample
	BG-3	0-12	TAL metals, hexavalent chromium, pH, ORP	Low		1	1	Surface Soil Sample
	BG-4	0-12	TAL metals, hexavalent chromium, pH, ORP	Low		1	1	Surface Soil Sample
	BG-5	0-12	TAL metals, hexavalent chromium, pH, ORP	Low		1	1	Surface Soil Sample

QAPP Worksheet #18-1: RI Sampling: Soil

Matrix: Soil

Sampling Locations and Methods/SOP Requirements Table

Location	Sample ID	Depth Interval (inches)	Analytical Group	Concentration Level	Sample Collection Protocol[1]	Minimum # of Samples	Maximum # of Samples	Comment
	BG-6	0-12	TAL metals, hexavalent chromium, pH, ORP	Low		1	1	Surface Soil Sample
	BG-7	0-12	TAL metals, hexavalent chromium, pH, ORP	Low		1	1	Surface Soil Sample
	BG-8	0-12	TAL metals, hexavalent chromium, pH, ORP	Low		1	1	Surface Soil Sample
	BG-9	0-12	TAL metals, hexavalent chromium, pH, ORP	Low		1	1	Surface Soil Sample
	BG-10	0-12	TAL metals, hexavalent chromium, pH, ORP	Low		1	1	Surface Soil Sample
	BG-11	0-12	TAL metals, hexavalent chromium, pH, ORP	Low		1	1	Surface Soil Sample
	BG-12	0-12	TAL metals, hexavalent chromium, pH, ORP	Low		1	1	Surface Soil Sample
	BG-13	0-12	TAL metals, hexavalent chromium, pH, ORP	Low		1	1	Surface Soil Sample

[1] Refer to Sections 9.2.1 and 9.2.2 of the QAPP for sampling procedures.
TBD – To Be Determined

Worksheet #18-2: RI Sampling: Sediment and Surface Water

Matrix: Sediment, Surface Water and Stream Bank Soil

Sampling Locations and Methods/SOP Requirements Table[1]

Location		Sample ID	Matrix	Analytical Group	Concentration Level	Depth Interval [1, 2] (feet)
Hudson Branch						
1	Quiescent, Low Energy Area	**SW-01**	Surface Water	TCL VOCs, TAL Metals, Cr+6, Hardness, FP	Low	0.5 BAWI
2	Transect, Mid-Channel Sediment	**SD-01B**	Sediment	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, TOC, PGS, pH	Low	1.5 - 2 BWSI
3	Transect, North Bank Soil	**SD-01N**	Stream Bank Soil	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, Cr+6, pH, ORP	Low	0 - 1 BGS
4	Transect, South Bank Soil	**SD-01S**	Stream Bank Soil	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, Cr+6, pH, ORP	Low	0 - 1 BGS
5	Quiescent, Low Energy Area	**SW-10**	Surface Water	TCL VOCs, TAL Metals, Cr+6, Hardness, FP	Low	0.5 BAWI
6	Transect, Mid-Channel Sediment	**SD-10B**	Sediment	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, TOC, PGS, pH	Low	1.5 - 2 BWSI
7	Transect, North Bank Soil	**SD-10N**	Stream Bank Soil	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, Cr+6, pH, ORP	Low	0 - 1 BGS
8	Transect, South Bank Soil	**SD-10S**	Stream Bank Soil	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, Cr+6, pH, ORP	Low	0 - 1 BGS
9	Quiescent, Low Energy Area	**SW-13**	Surface Water	TCL VOCs, TAL Metals, Cr+6, Hardness, FP	Low	0.5 BAWI
10	Transect, Mid-Channel Sediment	**SD-13B**	Sediment	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, TOC, PGS, pH	Low	1.5 - 2 BWSI
11	Transect, North Bank Soil	**SD-13N**	Stream Bank Soil	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, Cr+6, pH, ORP	Low	0 - 1 BGS
12	Transect, South Bank Soil	**SD-13S**	Stream Bank Soil	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, Cr+6, pH, ORP	Low	0 - 1 BGS
13	Quiescent, Low Energy Area	**SW-15**	Surface Water	TCL VOCs, TAL Metals, Cr+6, Hardness, FP	Low	0.5 BAWI
14	Transect, Mid-Channel Sediment	**SD-15B**	Sediment	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, TOC, PGS, pH	Low	1.5 - 2 BWSI
15	Transect, North Bank Soil	**SD-15N**	Stream Bank Soil	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, Cr+6, pH, ORP	Low	0 - 1 BGS
16	Transect, South Bank Soil	**SD-15S**	Stream Bank Soil	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, Cr+6, pH, ORP	Low	0 - 1 BGS
17	Quiescent, Low Energy Area	**SW-18**	Surface Water	TCL VOCs, TAL Metals, Cr+6, Hardness, FP	Low	0.5 BAWI

Worksheet #18-2: RI Sampling: Sediment and Surface Water

Matrix: Sediment, Surface Water and Stream Bank Soil

Sampling Locations and Methods/SOP Requirements Table[1]

Location		Sample ID	Matrix	Analytical Group	Concentration Level	Depth Interval [1, 2] (feet)
18	Transect, Mid-Channel Sediment	**SD-18B**	Sediment	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, TOC, PGS, pH	Low	1.5 - 2 BWSI
19	Transect, North Bank Soil	**SD-18N**	Stream Bank Soil	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, Cr+6, pH, ORP	Low	0 - 1 BGS
20	Transect, South Bank Soil	**SD-18S**	Stream Bank Soil	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, Cr+6, pH, ORP	Low	0 - 1 BGS
21	Quiescent, Low Energy Area	**SW-04**	Surface Water	TCL VOCs, TAL Metals, Cr+6, Hardness, FP	Low	0.5 BAWI
22	Transect, Mid-Channel Sediment	**SD-04B**	Sediment	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, TOC, PGS, pH	Low	1.5 - 2 BWSI
23	Transect, North Bank Soil	**SD-04N**	Stream Bank Soil	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, Cr+6, pH, ORP	Low	0 - 1 BGS
24	Transect, South Bank Soil	**SD-04S**	Stream Bank Soil	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, Cr+6, pH, ORP	Low	0 - 1 BGS
25	Quiescent, Low Energy Area	**SW-23**	Surface Water	TCL VOCs, TAL Metals, Cr+6, Hardness, FP	Low	0.5 BAWI
26	Transect, Mid-Channel Sediment	**SD-23B**	Sediment	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, TOC, PGS, pH	Low	1.5 - 2 BWSI
27	Transect, North Bank Soil	**SD-23N**	Stream Bank Soil	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, Cr+6, pH, ORP	Low	0 - 1 BGS
28	Transect, South Bank Soil	**SD-23S**	Stream Bank Soil	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, Cr+6, pH, ORP	Low	0 - 1 BGS
29	On-Site Impoundment (Pond, Depositional Area)	**SD-IMP1A**	Sediment	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, TOC, PGS, pH	Low	0 - 0.5 BWSI
30		**SD-IMP2A**	Sediment	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, TOC, PGS, pH	Low	0 - 0.5 BWSI
31		**SD-IMP3A**	Sediment	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, TOC, PGS, pH	Low	0 - 0.5 BWSI
32		**SD-IMP4A**	Sediment	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, TOC, PGS, pH	Low	0 - 0.5 BWSI
33		**SD-IMP5A**	Sediment	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, TOC, PGS, pH	Low	0 - 0.5 BWSI
34		**SD-IMP6A**	Sediment	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, TOC, PGS, pH	Low	0 - 0.5 BWSI
Burnt Mill Pond						
35	Quiescent, Low Energy Area	**SW-25**	Surface Water	TAL Metals, Cr+6, Hardness, FP, VOCs*	Low	0.5 BAWI
36	Pond, Depositional Area	**SD-25B**	Sediment	TAL Metals, TOC, PGS, pH	Low	0 – 0.5 BWSI

Worksheet #18-2: RI Sampling: Sediment and Surface Water

Matrix: Sediment, Surface Water and Stream Bank Soil

Sampling Locations and Methods/SOP Requirements Table[1]

Location		Sample ID	Matrix	Analytical Group	Concentration Level	Depth Interval [1, 2] (feet)
37	Quiescent, Low Energy Area	**SW-26**	Surface Water	TAL Metals, Cr+6, Hardness, FP, VOCs*	Low	0.5 BAWI
38	Pond, Depositional Area	**SD-26B**	Sediment	TAL Metals, TOC, PGS, pH	Low	0 – 0.5 BWSI
39	Quiescent, Low Energy Area	**SW-27**	Surface Water	TAL Metals, Cr+6, Hardness, FP, VOCs*	Low	0.5 BAWI
40	Pond, Depositional Area	**SD-27B**	Sediment	TAL Metals, TOC, PGS, pH	Low	0 – 0.5 BWSI
41	Quiescent, Low Energy Area	**SW-29**	Surface Water	TAL Metals, Cr+6, Hardness, FP, VOCs*	Low	0.5 BAWI
42	Pond, Depositional Area	**SD-29B**	Sediment	TAL Metals, TOC, PGS, pH	Low	0 – 0.5 BWSI
Burnt Mill Branch						
43	Quiescent, Low Energy Area	**SW-28**	Surface Water	TAL Metals, Cr+6, Hardness, FP	Low	0.5 BAWI
44	Transect, Mid-Channel Sediment	**SD-28A**	Sediment	TAL Metals, TOC, PGS, pH	Low	0 - 0.5 BWSI
45	Quiescent, Low Energy Area	**SW-38**	Surface Water	TAL Metals, Cr+6, Hardness, FP	Low	0.5 BAWI
46	Transect, Mid-Channel Sediment	**SD-38A**	Sediment	TAL Metals, TOC, PGS, pH	Low	0 - 0.5 BWSI
Burnt Mill Branch (Background Locations)						
47	Quiescent, Low Energy Area	**SW-30**	Surface Water	TCL VOCs, TAL Metals, Cr+6, Hardness, FP	Low	0.5 BAWI
48	Transect, Mid-Channel Sediment	**SD-30A**	Sediment	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, TOC, PGS, pH	Low	0 - 0.5 BWSI
49	Quiescent, Low Energy Area	**SW-31**	Surface Water	TCL VOCs, TAL Metals, Cr+6, Hardness, FP	Low	0.5 BAWI
50	Transect, Mid-Channel Sediment	**SD-31A**	Sediment	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, TOC, PGS, pH	Low	0 - 0.5 BWSI
51	Quiescent, Low Energy Area	**SW-32**	Surface Water	TCL VOCs, TAL Metals, Cr+6, Hardness, FP	Low	0.5 BAWI
52	Transect, Mid-Channel Sediment	**SD-32A**	Sediment	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, TOC, PGS, pH	Low	0 - 0.5 BWSI
53	Quiescent, Low Energy Area	**SW-33**	Surface Water	TCL VOCs, TAL Metals, Cr+6, Hardness, FP	Low	0.5 BAWI
54	Transect, Mid-Channel Sediment	**SD-33A**	Sediment	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, TOC, PGS, pH	Low	0 - 0.5 BWSI
55	Quiescent, Low Energy Area	**SW-34**	Surface Water	TCL VOCs, TAL Metals, Cr+6, Hardness, FP	Low	0.5 BAWI
56	Transect, Mid-Channel Sediment	**SD-34A**	Sediment	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, TOC, PGS, pH	Low	0 - 0.5 BWSI
57	Quiescent, Low Energy Area	**SW-35**	Surface Water	TCL VOCs, TAL Metals, Cr+6, Hardness, FP	Low	0.5 BAWI

Worksheet #18-2: RI Sampling: Sediment and Surface Water

Matrix: Sediment, Surface Water and Stream Bank Soil

Sampling Locations and Methods/SOP Requirements Table[1]

Location		Sample ID	Matrix	Analytical Group	Concentration Level	Depth Interval [1, 2] (feet)
58	Transect, Mid-Channel Sediment	**SD-35A**	Sediment	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, TOC, PGS, pH	Low	0 - 0.5 BWSI
59	Quiescent, Low Energy Area	**SW-36**	Surface Water	TCL VOCs, TAL Metals, Cr+6, Hardness, FP	Low	0.5 BAWI
60	Transect, Mid-Channel Sediment	**SD-36A**	Sediment	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, TOC, PGS, pH	Low	0 - 0.5 BWSI
61	Quiescent, Low Energy Area	**SW-37**	Surface Water	TCL VOCs, TAL Metals, Cr+6, Hardness, FP	Low	0.5 BAWI
62	Transect, Mid-Channel Sediment	**SD-37A**	Sediment	TCL Semi-VOCs and pesticides/PCBs, TAL Metals, TOC, PGS, pH	Low	0 - 0.5 BWSI

[1]Refer to Section 9.2.3 of the QAPP for sampling procedures.

- For Surface Water, sample collection will be 0.5 feet below air-water interface (BAWI).
- For Sediment, sample collection depth intervals will be 0 – 0.5 feet and 1.5 – 2.0 feet below water-sediment interface (BWSI).
- For Soil, sample collection depth interval will be 0 – 0.5 feet below ground surface (bgs).

PGS – Particle grain size
FP – Field parameters
*Analysis of VOC samples will be dependent upon results of VOC analyses in Hudson Branch surface water samples; see Worksheet #17.

QAPP Worksheet #18-3: BERA Sampling:

Matrix: Surface Soil

Sampling Locations and Methods/SOP Requirements Table

Location	Sample ID[1]	Depth Interval (inches)	Analytical Group	Concentration Level	Sample Collection Protocol[2]	Minimum # of Samples	Maximum # of Samples
Hudson Branch	BERA-SS-01	0-12	Chromium, Vanadium	Low	Surface soil samples will be collected from exposed ground surface to 1 ft. below ground.	1	1
	BERA-SS-02	0-12	Chromium, Vanadium	Low		1	1
	BERA-SS-03	0-12	Chromium, Vanadium	Low		1	1
	BERA-SS-04	0-12	Chromium, Vanadium	Low		1	1
	BERA-SS-05	0-12	Chromium, Vanadium	Low		1	1
	BERA-SS-06	0-12	Chromium, Vanadium	Low		1	1
	BERA-SS-07	0-12	Chromium, Vanadium	Low		1	1
	BERA-SS-08	0-12	Chromium, Vanadium	Low		1	1
Eastern Storage Areas	BERA-SS-09	0-12	Chromium, Vanadium	Low	Surface soil samples will be collected from exposed ground surface to 1 ft. below ground.	1	1

QAPP Worksheet #18-3: BERA Sampling:

Matrix: Surface Soil

Sampling Locations and Methods/SOP Requirements Table

Location	Sample ID[1]	Depth Interval (inches)	Analytical Group	Concentration Level	Sample Collection Protocol[2]	Minimum # of Samples	Maximum # of Samples
	BERA-SS-10	0-12	Chromium, Vanadium	Low		1	1
	BERA-SS-11	0-12	Chromium, Vanadium	Low		1	1
	BERA-SS-12	0-12	Chromium, Vanadium	Low		1	1
	BERA-SS-13	0-12	Chromium, Vanadium	Low		1	1
	BERA-SS-14	0-12	Chromium, Vanadium	Low		1	1
Background	BERA-SS-15	0-12	Chromium, Vanadium	Low		1	1
	BERA-SS-16	0-12	Chromium, Vanadium	Low		1	1

[1]Refer to Figure C-1 in the BERA Work Plan for approximate sample locations; actual locations may be adjusted in the field based upon field observations.
[2]Refer to Section 9.2.1 of the QAPP for sampling procedures

QAPP Worksheet #18-4: BERA Sampling:

Matrix: Sediment

Sampling Locations and Methods/SOP Requirements Table

Location	Sample ID[1]	Depth Interval (inches)	Analytical Group	Concentration Level	Sample Collection Protocol[2]	Minimum # of Samples	Maximum # of Samples
Hudson Branch	BERA-SD-01	0-0.5 BWSI	Metals[3]	Low	Sediment samples will be collected 0.5 feet below water-sediment interface (BWSI).	1	1
	BERA-SD-02	0-0.5 BWSI	Metals[3]	Low		1	1
	BERA-SD-03	0-0.5 BWSI	Metals[3]	Low		1	1
	BERA-SD-04	0-0.5 BWSI	Metals[3]	Low		1	1
	BERA-SD-05	0-0.5 BWSI	Metals[3]	Low		1	1
	BERA-SD-06	0-0.5 BWSI	Metals[3]	Low		1	1
	BERA-SD-07	0-0.5 BWSI	Metals[3]	Low		1	1
	BERA-SD-08	0-0.5 BWSI	Metals[3]	Low		1	1
Background	BERA-SD-09	0-0.5 BWSI	Metals[3]	Low	Sediment samples will be collected 0.5 feet below water-sediment interface (BWSI).	1	1

QAPP Worksheet #18-4: BERA Sampling:

Matrix: Sediment

Sampling Locations and Methods/SOP Requirements Table

Location	Sample ID[1]	Depth Interval (inches)	Analytical Group	Concentration Level	Sample Collection Protocol[2]	Minimum # of Samples	Maximum # of Samples
	BERA-SD-10	0-0.5 BWSI	Metals[3]	Low		1	1

[1]Refer to Figure C-1 in the BERA Work Plan for approximate sample locations; actual locations may be adjusted in the field based upon field observations.
[2]Refer to Section 9.2.3 of the QAPP for sampling procedures
[3]Antimiony, barium, beryllium, chromium, copper, lead, mercury, nickel, selenium, vanadium, zinc
BWSI – below water-sediment interface

QAPP Worksheet #18-5: BERA Sampling:

Matrix: Aquatic Vegetation

Sampling Locations and Methods/SOP Requirements Table

Location	Sample ID[1]	Analytical Group	Concentration Level	Sample Collection Protocol[2]	Minimum # of Samples	Maximum # of Samples
Hudson Branch	BERA-AV-01	Chromium	Low	.	1	1
	BERA-AV-02	Chromium	Low		1	1
	BERA-AV-03	Chromium	Low		1	1
	BERA-AV-04	Chromium	Low		1	1
	BERA-AV-05	Chromium	Low		1	1
	BERA-AV-06	Chromium	Low		1	1
	BERA-AV-07	Chromium	Low		1	1
	BERA-AV-08	Chromium	Low		1	1
Background	BERA-AV-09	Chromium	Low		1	1

QAPP Worksheet #18-5: BERA Sampling:

Matrix: Aquatic Vegetation

Sampling Locations and Methods/SOP Requirements Table

Location	Sample ID[1]	Analytical Group	Concentration Level	Sample Collection Protocol[2]	Minimum # of Samples	Maximum # of Samples
	BERA-AV-10	Chromium	Low		1	1

[1]Refer to Figure C-1 in the BERA Work Plan for approximate sample locations; actual locations may be adjusted in the field based upon field observations.
[2]Refer to Section 9.2.4 of the QAPP for sampling procedures.

QAPP Worksheet #18-6: BERA Sampling:

Matrix: Aquatic Invertebrates

Sampling Locations and Methods/SOP Requirements Table

Location	Sample ID[1]	Analytical Group	Concentration Level	Sample Collection Protocol[2]	Minimum # of Samples	Maximum # of Samples
Hudson Branch	BERA-AI-01	Metals[3]	Low		1	1
	BERA-AI-02	Metals[3]	Low		1	1
	BERA-AI-03	Metals[3]	Low		1	1
	BERA-AI-04	Metals[3]	Low		1	1
	BERA-AI-05	Metals[3]	Low		1	1
	BERA-AI-06	Metals[3]	Low		1	1
	BERA-AI-07	Metals[3]	Low		1	1
	BERA-AI-08	Metals[3]	Low		1	1
Background	BERA-AI-09	Metals[3]	Low		1	1

QAPP Worksheet #18-6: BERA Sampling:

Matrix: Aquatic Invertebrates

Sampling Locations and Methods/SOP Requirements Table

Location	Sample ID[1]	Analytical Group	Concentration Level	Sample Collection Protocol[2]	Minimum # of Samples	Maximum # of Samples
	BERA-AI-10	Metals[3]	Low		1	1

[1]Refer to Figure C-1 in the BERA Work Plan for approximate sample locations; actual locations may be adjusted in the field based upon field observations.
[2]Refer to Section 9.2.4 of the QAPP for sampling procedures.
[3]Antimiony, barium, chromium, copper, mercury, vanadium

QAPP Worksheet #18-7: BERA Sampling:

Matrix: Terrestrial Invertebrates*

Sampling Locations and Methods/SOP Requirements Table

Location	Sample ID[1]	Analytical Group	Concentration Level	Sample Collection Protocol[2]	Minimum # of Samples	Maximum # of Samples
Hudson Branch	BERA-TI-01	Chromium, Vanadium	Low	.	1	1
	BERA-TI-02	Chromium, Vanadium	Low		1	1
	BERA-TI-03	Chromium, Vanadium	Low		1	1
	BERA-TI-04	Chromium, Vanadium	Low		1	1
	BERA-TI-05	Chromium, Vanadium	Low		1	1
	BERA-TI-06	Chromium, Vanadium	Low		1	1
	BERA-TI-07	Chromium, Vanadium	Low		1	1
	BERA-TI-08	Chromium, Vanadium	Low		1	1

QAPP Worksheet #18-7: BERA Sampling:

Matrix: Terrestrial Invertebrates*

Sampling Locations and Methods/SOP Requirements Table

Location	Sample ID[1]	Analytical Group	Concentration Level	Sample Collection Protocol[2]	Minimum # of Samples	Maximum # of Samples
Eastern Storage Areas	BERA-TI-09	Chromium, Vanadium	Low	.	1	1
	BERA-TI-10	Chromium, Vanadium	Low		1	1
	BERA-TI-11	Chromium, Vanadium	Low		1	1
	BERA-TI-12	Chromium, Vanadium	Low		1	1
	BERA-TI-13	Chromium, Vanadium	Low		1	1
	BERA-TI-14	Chromium, Vanadium	Low		1	1
Background	BERA-TI-15	Chromium, Vanadium	Low		1	1
	BERA-TI-16	Chromium, Vanadium	Low		1	1

[1]Refer to Figure C-1 in the BERA Work Plan for approximate sample locations; actual locations may be adjusted in the field based upon field observations.
[2]Refer to Section 9.2.4 of the QAPP for sampling procedures.
*Earthworms may be collected in lieu of terrestrial invertebrates; refer to Section 9.2.4 of the QAPP for details. If earthworms are collected, the sample ID scheme will utilize "EW" in place of "TI".

9.1 Sampling Procedures and Requirements

This section provides an overview of how samples will be collected. The selected sampling procedures will ensure that representative samples are collected in a consistent manner, that contamination is not introduced during collection, and all required sample media/matrices at proposed sample locations and properly preserved volumes are collected in order to meet PQOs.

9.2 Sampling Procedures

Details on sampling procedures which will be utilized during sampling are discussed below.

Sample locations (soil, sediment, and surface water samples) will be horizontally located in the field based on proposed sample locations using GPS procedures. Labeled stakes or pin flags will be placed in the ground to mark the sample locations.

In paved areas, the asphalt or concrete will be cored prior to advancing the sampling tools. If refusal is encountered during borehole advancement or insufficient volume is obtained, the field team will step out approximately 5 feet from the first borehole location to permit the collection of the samples from the desired intervals.

The sample locations, appropriate number, size, and type of sample containers to be used for collection of all field samples and field QC samples are detailed on Worksheets #18-1 through 18-7, and 19.

9.2.1 Surface Soil Sampling

Surficial soil samples will be collected across the Site at pre-determined locations based on historical data in order to address data gaps and develop a sufficient database to support the risk assessments. Depending on the sample location, the soil samples will be analyzed for VOCs, TAL metals, vanadium, total chromium, hexavalent chromium, pH, and/or ORP.

At each sample location, surface debris (e.g., leaves, vegetation, rocks) will be removed from the surface before sampling commences. Surface soil samples will be collected using decontaminated or dedicated sampling equipment (i.e., bucket augers or scoops) from the exposed ground surface to six inches below ground surface (bgs). If gross contamination is observed, photographs will be taken to document the nature of the identified contamination.

Once the bucket auger, split spoon or scoop (containing the soil sample) has been withdrawn from the subsurface, each sample will be screened with a properly calibrated PID (MiniRAE 2000 or equivalent). The probe will be positioned immediately above the exposed area to record PID measurements. Surface soils to be analyzed for VOCs will be collected from the undisturbed sample from the 0.5-1 ft interval. When soil samples are collected for VOC analysis, a split spoon, macro liner or similar coring device will be used. The soil sample will be collected from the 0 to 12-inch interval for TAL metals, vanadium, pH, ORP and/or hexavalent chromium analyses, depending on the location.

Following this, an EnCore® sampler (one-time-use volumetric sampling and storage device) will be used to collect the sample for VOC analysis. During sample collection, the EnCore® sampler will be removed from the resealable foil package and placed into the EnCore® T -shaped handle. Prior to sample collection, the sampler must confirm that the plunger bottom is flush with the bottom of the coring body. The EnCore® handle is then used to push the EnCore® sampler directly into the soil matrix (of the selected 0.5 ft interval) and locked once the sample has been collected. The EnCore® sampler will be removed from the handle, capped, and placed back into the foil package. The foil package will be labeled and placed in a cooler on ice for transport to the laboratory. The laboratory will extrude the soil sample from the EnCore® sampler and preserve it within 48 hours of sample collection. Following sample collection, the EnCore® T-handle will be decontaminated for reuse at the next sample location.

Soil from the 0-12 inch depth interval will be collected for TAL metals, vanadium, total chromium, pH, ORP and/or hexavalent chromium analyses and will be homogenized in a decontaminated stainless steel bowl with a decontaminated stainless steel spoon. Once the sample has been homogenized, the sample will be transferred directly into the sample containers. Once the sample has been transferred into the appropriate containers, the bottles will be capped and, if necessary, the outside of the bottle wiped with a clean paper towel to remove excess soil. The sample containers will be labeled and placed in a cooler on ice for transport to the laboratory. The soil sample analyses along the property lines (SB-95 thru SB-97, SB-104 and SB-105) will be performed on an expedited turnaround (3-5 days). Based on these results, the Project Manager, in conjunction with EPA, will determine if additional horizontal delineation is necessary and direct the sampling team accordingly. Flow Diagram A-1 summarizes the sample collection protocol for surface soil sampling.

The soil will be classified using a modified Burmeister Classification System. Soil logs will be completed after sample collection to minimize losses due to volatilization and potential cross contamination due to excessive handling of the soil. Disposable gloves will be changed between each sample location. Care will be taken to minimize contact of disposable gloves with soil to be sent for laboratory analysis.

The aforementioned sampling procedure is summarized into the following step-by-step guidance:

1. Locate the sample location via the pre-determined GPS coordinates. Mark the location with a pin flag or wooden stake painted with a high visibility color.

2. Clear surface debris from the sampling location.

3. Using a bucket auger, split spoon, macro liner or sampling scoop, collect a soil sample down to a depth of 6 inches.

4. Screen the soil with a PID. Record PID readings in the field logbook.

5. Prior to collecting the VOC sample from the 0.5-1 ft interval, hold the coring body of the EnCore® sampler, and push the plunger rod down until the small o-ring rests against the tabs. This will assure that the plunger moves freely.

6. Depress locking level on EnCore® T -handle. Place coring body - plunger end first - into open end of T -handle, aligning the two slots on the coring body with the two locking pins in the T-handle. Twist coring body clockwise to lock pins in slots. Double check that sampler is locked in place prior to use.

7. To collect soil sample, turn T-handle such that "T" is up and coring body is down. This positions plunger bottom flush with the bottom of the coring body; double check that plunger bottom is in position.

8. Using T-handle, push the EnCore® sampler into the soil until coring body is completely full. When full, the small o-ring will be centered in the T-handle viewing hole.

9. Remove sampler from soil. Wipe any excess soil from the exterior of the coring body.

10. Cap coring body while it is still on T-handle. Push cap over flat area of ridge. Push and twist cap to lock in place - cap must be seated over coring body ridges to seal sampler.

11. Remove capped EnCore® sampler by depressing the locking lever on the T-handle while twisting and pulling sampler from T-handle.

12. Lock plunger by rotating extended plunger rod fully counter-clockwise until wings rest firmly against tabs.

13. Attach a completed label (provided with the EnCore® sampler in the bag) to the cap on the coring body container. Place sampler in zipper bag provided, and seal bag.

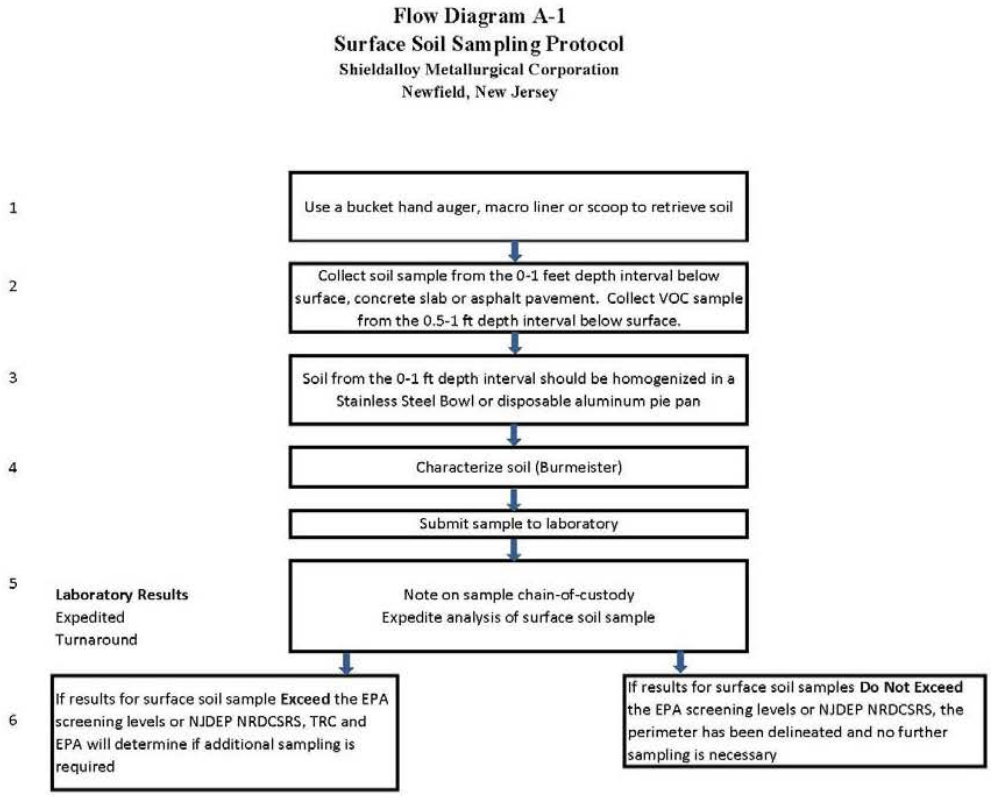
14. Place initialed custody seal(s) over the top of the closed EnCore® bag, in such a manner that the bag cannot be opened (even partially); two or more custody seals may be needed.

15. Attach a completed sample tag to the bag, using tape or other method, provided that the sample tag is securely fastened to the bag and will not become dislodged in transit.

16. Collect an additional aliquot of soil from each sample location in a separate jar, for percent moisture determination by the laboratory.

17. Soil from the 0 to 12 inches bgs depth interval will be homogenized in a decontaminated, stainless steel bowl or a disposable aluminum pie pan with a decontaminated stainless steel spoon. Once the sample has been homogenized, the sample will be transferred directly into the sample containers for TAL metals, vanadium, pH, ORP and/or hexavalent chromium analyses, depending on the location.

Flow Diagram A-1 Surface Soil Sampling Protocol



18. Classify soil using a modified Burmeister Classification System. Lithologic descriptions should be recorded in the field logbook.

19. Complete sampling labels on each container, cover label with clear packing tape, and place the samples in coolers for shipment and chill to 4°C.

20. Complete sample logs, custody seals, and chain-of-custody forms.

21. Soil sampling details should be recorded in a field logbook.

22. Initiate decontamination procedures on sampling equipment.

9.2.2 Subsurface Soil Sampling

Soil borings will be advanced at the former Manpro-Vibra Degreasing Unit and the former Basins B9 and B10 using a direct-push Geoprobe rig or hollow stem auger rig. Continuous soil samples will be collected from each boring from ground surface to the water table. Soil samples will be collected using decontaminated or dedicated sampling equipment (i.e., liners, split spoon sampler or equivalent soil coring tool).

Once the core sampler (containing the soil sample) has been withdrawn from the subsurface, the liner (or split spoon) will be placed on a table covered with plastic sheeting. Once the liner (or split spoon) is opened, each soil core will be screened with a properly calibrated PID (MiniRAE 2000 or equivalent) or FID (photovac MicroFID or equivalent). High humidity (or excess soil moisture) can interfere with the performance of a PID. Therefore, if these conditions are encountered, an FID should be used to conduct the soil screening. A decontaminated stainless steel spoon or knife will be used to make a longitudinal score deep along the length of the soil core to disturb the soil surface. The probe will be positioned immediately above the exposed, lateral scoring area to record PID/FID measurements in 6-inch intervals to determine the appropriate sample location. Based on the field screening with the PID/FID, the 6-inch depth interval of soil that displays the highest PID/FID readings or other evidence of impact (staining, sheens, etc.) will be selected for laboratory analysis within a given soil core depth interval. In the event that no PID/FID readings detected above background or other evidence of impact (staining, sheens, etc) are identified, the soil sample will be collected from the 6-inch interval above the water table. If evidence of contamination exists, an additional sample will be collected for vertical delineation. The subsurface soil samples from the Manpro-Vibra Degreasing Unit will be analyzed for TCL VOCs only and the subsurface soil samples from the Former Lagoons Area will be analyzed for TCL VOCs, vanadium, hexavalent chromium, pH, and/or ORP.

The analysis of VOCs for subsurface soil samples with evidence of contamination will be performed on an expedited turnaround (3-5 days) by the laboratory for the first depth interval. The expedited turnaround of sampling results will facilitate active decision-making in the field to rapidly delineate the horizontal and vertical extent of site contamination. Based on these expedited results, the Project Manager or Field Team Manager will direct the laboratory to either analyze or discard the soil samples temporarily archived. The Project Manager, in conjunction

with EPA, will also determine if additional horizontal or vertical delineation borings are necessary and direct the sampling team accordingly.

Flow Diagram A-2 summarizes the sample collection protocol for the subsurface soil sampling.

For simplicity, the aforementioned sampling procedure is summarized into the following step-by-step guidance:

1. Clear surface debris from the sampling location.

2. Collect continuous soil samples with liners, split spoon or coring device to the water table. Withdraw and carefully open liner or split spoon.

3. Score the soil with a knife longitudinally and screen the exposed soil with a PID/FID in 6-inch increments. PID/FID readings should be recorded in a field logbook.

4. Sample the 6-inch zone displaying the highest PID/FID reading (or soil displaying staining, sheens) for volatile organic analysis using an EnCore® sampler. If no PID/FID readings are observed or evidence of impact, the sample should be collected from the 0.5 foot interval above the water table. PID/FID readings should be recorded in a field logbook.

5. Prior to collecting the sample, hold the coring body of the EnCore® sampler, and push the plunger rod down until the small o-ring rests against the tabs. This will assure that the plunger moves freely.

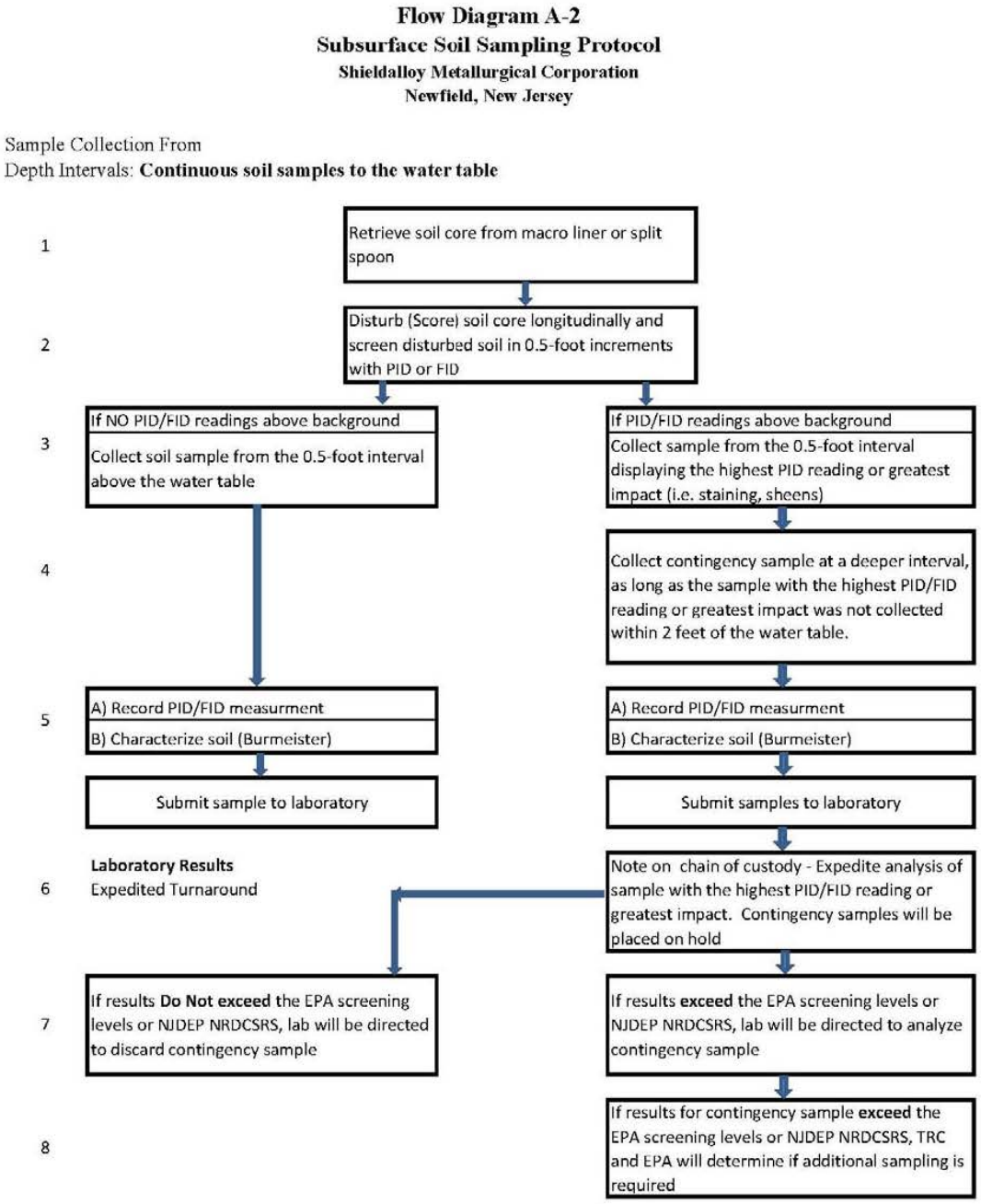
6. Depress locking level on EnCore® T -handle. Place coring body - plunger end first - into open end of T -handle, aligning the two slots on the coring body with the two locking pins in the T-handle. Twist coring body clockwise to lock pins in slots. Double check that sampler is locked in place prior to use.

7. To collect soil sample, turn T-handle such that "T" is up and coring body is down. This positions plunger bottom flush with the bottom of the coring body; double check that plunger bottom is in position.

8. Using T-handle, push the EnCore® sampler into the soil until coring body is completely full. When full, the small o-ring will be centered in the T-handle viewing hole.

9. Remove sampler from soil. Wipe any excess soil from the exterior of the coring body.

Flow Diagram A-2 Subsurface Soil Sampling Protocol



10. Cap coring body while it is still on T-handle. Push cap over flat area of ridge. Push and twist cap to lock in place - cap must be seated over coring body ridges to seal sampler.

11. Remove capped EnCore® sampler by depressing the locking lever on the T-handle while twisting and pulling sampler from T-handle.

12. Lock plunger by rotating extended plunger rod fully counter-clockwise until wings rest firmly against tabs.

13. Attach a completed label (provided with the EnCore® sampler in the bag) to the cap on the coring body container. Place sampler in zipper bag provided, and seal bag.

14. Place initialed custody seal(s) over the top of the closed EnCore® bag, in such a manner that the bag cannot be opened (even partially); two or more custody seals may be needed.

15. Attach a completed sample tag to the bag, using tape or other method, provided that the sample tag is securely fastened to the bag and will not become dislodged in transit.

16. Collect an additional aliquot of soil from each sample location in a separate jar, for percent moisture determination by the laboratory.

17. Classify soil using a modified Burmeister Classification System. Lithologic descriptions should be recorded in the field logbook.

18. The remaining soil in the liner or split spoon from the target interval should be homogenized in a decontaminated, stainless steel bowl or disposable aluminum pie pan. Once the sample has been homogenized, the sample will be transferred directly into the sample containers for vanadium, pH, ORP and/or hexavalent chromium analyses, depending on the location.

19. Complete sampling labels on each container and place the analytical samples in coolers for shipment and chill to 4°C.

20. Complete sample logs, custody seals, and chain of custody forms.

21. Record the soil sampling details in the field logbook.

22. Return excess soil material to the borehole and place wooden stake to mark the location.

23. Initiate decontamination procedures on sampling equipment.

9.2.3 Sediment and Surface Water Sampling

The objective of the sediment and surface water sampling program is to obtain a current representation of the aquatic environment conditions in the Hudson Branch, Burnt Mill Pond, Burnt Mill Branch, and in the on-site impoundment that discharges to the Hudson Branch. In addition, sediment and surface water sampling is being conducted to delineate the extent of contamination in the Hudson Branch and Burnt Mill Pond and to assess background conditions. Prior to sample collection, a GPS unit will be used to relocate sediment and surface water sample locations.

The samples will be collected sequentially beginning at the most downstream location and ending with the upstream location, to eliminate the potential for cross-contamination between sampling locations and ensure sample quality.

9.2.3.1 Sampling Locations

Sample locations are summarized on Worksheet #18-2. Sample locations are indicated in Figure 17 of the RI Work Plan. Dry weather conditions will be targeted for sediment sampling. Therefore, select surface water locations in the upper reaches of the Hudson Branch may be dry. If a surface water location is dry, a sample will not be collected.

9.2.3.2 Surface Water Sampling Procedure

At each location, the surface water will be collected first, followed by collection of the sediment samples. Surface water samples will be collected spatially and temporally with sediment samples. The sampling device (open mouth container) will be fully submerged (beneath the air-water interface) and located directly above the sediment bed, pointing the open mouth of the container upstream. Once the sample has been collected, the liquid sample will be transferred directly into the pre-preserved sample bottles. The pre-preserved sample containers will be labeled and placed in a cooler on ice to await transport to the laboratory. The surface water samples will be analyzed for TCL VOCs, TAL metals (total and dissolved), hexavalent chromium (total and dissolved), and total hardness. Water quality measurements (including temperature, pH, redox potential, turbidity, salinity, conductivity and dissolved oxygen) will be subsequently collected using field instrumentation (Horiba® water quality meter or equivalent). The sample location and field measurements will be recorded in a field logbook. A flow meter (global water flow probe or other equivalent digital water velocity meter) will also be utilized to measure the stream flow within the mid-point of the stream channel. Finally, the sample location will be photographed, flagged and the physical characteristics (width, depth, flow) of the stream sampling location will be recorded in the field logbook.

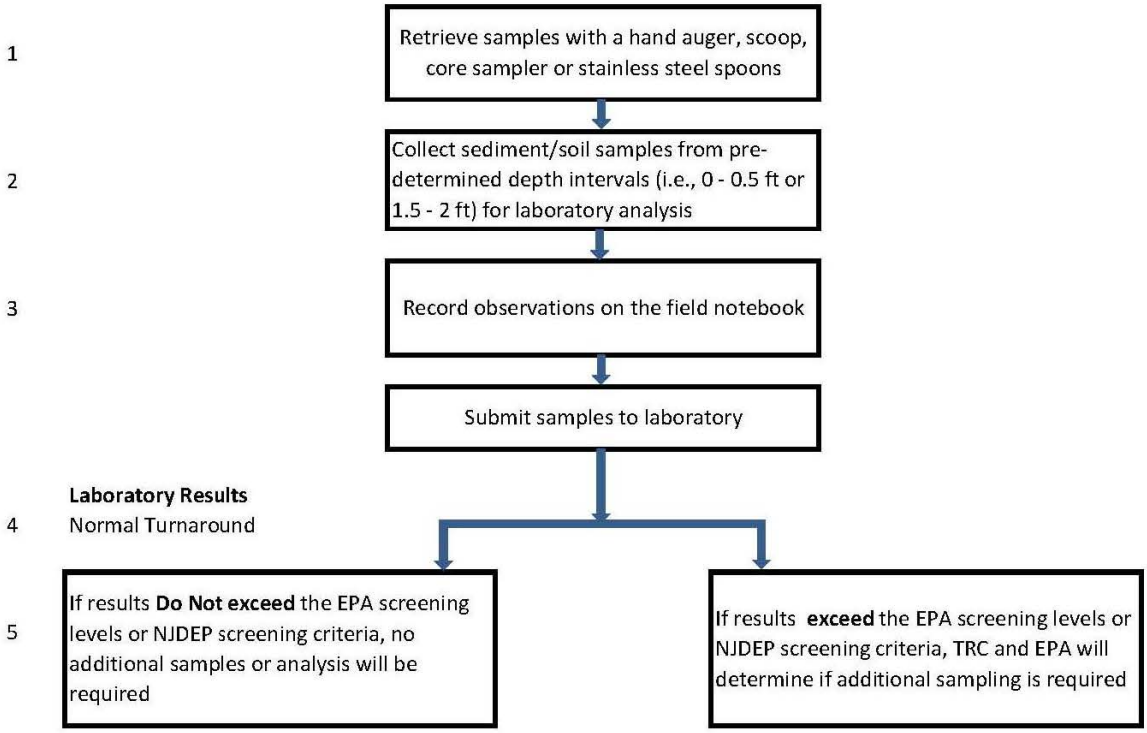
9.2.3.3 Sediment and Stream Bank Soil Sampling Procedure

The sediment samples will be retrieved using a decontaminated 4-inch diameter PVC pipe that will be driven into the sediment to a pre-determined depth based on Worksheet #18-2. At a

Flow Diagram A-3 Sediment/Soil Sampling Protocol

Flow Diagram A-3
Sediment/Soil Sampling Protocol
Shieldalloy Metallurgical Corporation
Newfield, New Jersey

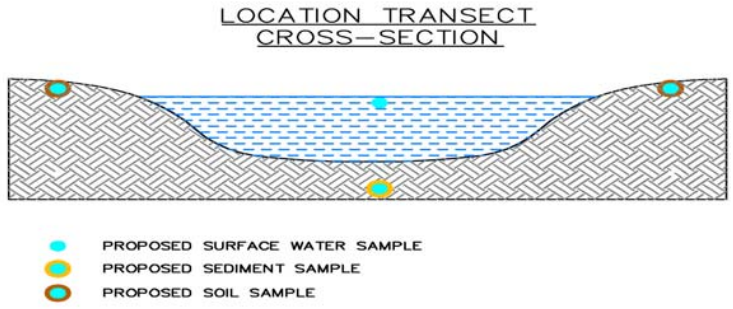
Sediment/Soil Sample Collection From
Pre-Determinated Depth Intervals: **0 - 0.5 ft or 1.5 - 2 ft**



minimum, the pipe will be driven 0.5-foot deeper than the deepest sample interval, if practicable. Prior to installation, the pre-determined depth will be marked on the outside of the PVC piping so as to provide a visual reference during installation. Note that this depth will be modified as necessary (e.g., increased) to account for standing water. Sediment samples will be collected within the pipe using decontaminated stainless steel hand augers or a sediment core sampler. The technique will allow for the collection of sediment samples with minimal collapse of the borehole, as the PVC pipe will impede the influx of water. Flow Diagram A-3 summarizes the sample collection protocol for the sediment sampling.

At locations for transects, stream bank samples will be collected from the 0.5-foot depth interval below surface. The stream bank samples will be collected using decontaminated or dedicated sampling equipment (i.e., hand augers, scoops, core samplers or stainless steel spoons).

A transect cross section for collection of surface water, sediment and soil samples is provided below.



Not to Scale

The contents from each auger, scoop, or stainless steel spoon will be placed into a dedicated stainless steel bowl or disposable aluminum pie pan and homogenized. The sediment samples will be geologically logged for grain size, color, texture, consistency and other physical parameters (e.g., stains, odors, etc.) and the observations will be recorded in the field logbook. Once homogenized, the sample will be transferred into the appropriate sample containers. Any excess liquid present with the sediment sample will be placed in the sample container. Decantation of excess liquids may promote the loss of water-soluble-compounds present in the sediment. If the sample is collected properly, any liquid that makes it into the bottle will be representative of the sediment conditions. The sample containers will be labeled and placed in a cooler on ice to await transport to the laboratory. The sediment samples will be analyzed for TCL SVOCs, TCL pesticides, PCB Aroclors, TAL metals, TOC, pH, and particle grain size distribution. TOC and particle grain size are included as indicators of contaminant bioavailability and the depositional nature of the sediments.

All analyses of sediment and stream bank soil samples will be performed on normal turnaround by the laboratory. Based on these results, the Project Manager, in conjunction with EPA, will

determine if additional horizontal and/or vertical delineation are necessary and direct the sampling team accordingly.

The field samplers will complete sample logs, labels, custody seals, and chain-of-custody forms and record all sampling details in the field logbook. The sediment sample locations are subject to field adjustment, based on site conditions and observations made at the time of sample collection. Decisions regarding final sample locations may be based on accessibility restrictions, discharge points, sediment depositional zones and other factors that may be encountered or observed during the field sampling.

The sediment sample locations will be photographed, flagged and the physical characteristics (width and depth, flow) of the stream sampling location will be recorded in the field logbook.

9.2.4 Aquatic Vegetation, Aquatic Invertebrate and Terrestrial Invertebrate Sampling: BERA

Invertebrate samples will be collected at each sampling location and will include representative species present. Each terrestrial invertebrate sample will be co-located with surface soil sampling locations. Each aquatic vegetation and aquatic invertebrate sample will be co-located with sediment sampling locations. Invertebrates and vegetation should be collected as close as possible to the surface soil or sediment sampling location initially with sampling extending radially from the soil/sediment sample until sufficient invertebrate mass is collected. An attempt will be made to get a minimum of 10 grams at each location. Terrestrial invertebrates can be collected by searching under rocks, debris and by sweeping vegetation with a heavy-duty sweep net. Any vegetation and terrestrial invertebrates retained for sampling should be free of loose soil, sediment and detritus. Samples should be placed into glass jars.

In the event that a sufficient mass of terrestrial invertebrate tissue cannot be collected at a particular area of concern, then a laboratory-based bioaccumulation study from soil to earthworms will be undertaken. The laboratory bioaccumulation study involves placing earthworms (*Eisenia foetida*) into soil samples collected from the Site for a period of 28 days. The earthworm bioaccumulation test will follow ASTM D1676-97 guidelines. After the exposure period is complete, earthworms are analyzed for the metals of concern. These results are then compared to the soil sampling results to determine appropriate site-specific bioaccumulation factors.

Each sample should be labeled with the sample location and date of collection. A field notebook should record invertebrate types collected at the sampling location and their relative percent contribution to the sample. Invertebrates should be identified in the field to the lowest practicable taxon. Samples should be placed on ice in a cooler.

9.2.5 Investigation Derived Waste Sampling

Investigation derived waste (IDW) residuals will be containerized and sampled to make a hazardous waste determination. Following generation, the IDW will be containerized and staged adjacent and south of the treatment plan to await characterization. Based on the sampling results

and consultation with the EPA Remedial Project Manager, a subsequent determination shall be made whether IDW can be placed on-site.

Personnel directly involved in equipment decontamination will wear appropriate protective clothing, as stated in the HASP. Used personal protective equipment (PPE) and any gross solids removed from the equipment during the physical removal process shall be stored in a drum. The soap and water liquid wastes will also be stored in an appropriate drum or container. The diluted acid rinsate will be stored in an appropriate container or neutralized with a base and then placed in an appropriate drum. The solvent rinse wastewater shall be placed into an appropriate container or drum. The final rinse wastewater shall be emptied onto the ground.

All waste handling will be conducted in accordance with all applicable federal and state regulations. The containers used to store IDW will be new USDOT-approved drums classified as 1A1/Y 340/S (or equivalent lined with a 6-millimeter liner).

9.3 Cleaning and Decontamination of Personnel, Equipment and Sample Containers

This section describes the procedures for the initial cleaning of sample equipment and subsequent decontamination procedures that will be followed during each sampling event. Cleaning/decontamination procedures apply to all equipment that come in contact with a sample.

Decontamination will be conducted in accordance with the NJDEP Field Sampling Procedures Manual (2005) and EPA's August 11, 1994 SOP No. 2006, “Sampling Equipment Decontamination”. Proper decontamination is required for all personnel before leaving the site. A decontamination area shall be designated within the Contamination Reduction Zone prior to the implementation of field activities and shall be cordoned off to restrict unauthorized personnel. The decontamination will be accomplished through a systematic procedure of cleaning and removing PPE. Contaminants can adhere to the surface of PPE or permeate PPE material. It is important to avoid bodily contact with contaminated material, and to prevent contamination of the Support Zone. All contaminated material that becomes attached to clothing or equipment must be removed and/or neutralized in either the Exclusion Zone or the Contamination Reduction Zone. PPE decontamination will include the following: washing of boots (or the removal and disposal of boot covers); washing, removal and disposal of disposable coveralls (or protective suits); removal and disposal of outer and inner gloves and finally, washing of hands, arms and face prior to leaving the site. Disposable PPE will be carefully removed and placed in plastic bags and sealed. When reusable PPE is worn, it must be decontaminated on site. After cleaning, the reusable PPE will be sealed in plastic bags for return shipment.

All non-disposable equipment involved in field sampling activities will be decontaminated prior to and after sampling. Equipment leaving the Site will also be decontaminated. Alconox and water wash will be used to remove all visible particulate matter and residual oils and grease. This may be preceded by using high pressure water or steam to facilitate residual removals. All heavy equipment (e.g., backhoe) will be steam cleaned prior to and after use.

In general, soil sediment, and invertebrate/vegetation sampling equipment will be decontaminated using the following procedure:

- Laboratory grade glassware detergent plus tap water wash
- Generous tap water rinse
- Distilled deionized (ASTM Type II) water rinse
- 10% nitric acid rinse (trace metal or higher grade HNO_3 diluted with distilled and deionized [ASTM type II] H_2O)
- Distilled and deionized (ASTM Type II) water rinse
- Acetone (pesticide grade) rinse (if sample is analyzed for organics)
- Total air dry
- Distilled and deionized (ASTM Type II) water rinse

Pre-cleaned bottles will be used for all sampling procedures. These bottles will be supplied by an external vendor. The certificates of cleanliness will be kept in project files located at the TRC Environmental office in Philadelphia, PA.
The following table represents a complete list of all equipment that will come in contact with each sample for each medium/matrix.

Equipment	Matrices	
	Sediment[2]	**Soil[3]**
Stainless steel hand augers[1]	X	X
Stainless steel scoops[1]	X	X
Stainless steel spoon[1]	X	X
Encore® T-handle		X
Stainless steel bowl[1]	X	X
Aluminum pie pan	X	X
Bucket augers		X

[1] Plastic may be used instead of stainless steel if collecting samples for inorganics only.

[2] Equipment used for sediment samples will also be used for aquatic vegetation and aquatic invertebrates.

[3] Equipment used for surface soil samples will also be used for terrestrial invertebrates.

9.4 Field Equipment

9.4.1 Field Equipment Calibration

No field sampling equipment calibration is anticipated for this program.

9.4.2 Field Equipment, Maintenance, Testing, and Inspection Requirements

The field equipment preventative maintenance program is designed to ensure the effective completion of the sampling effort and to minimize equipment downtime. The maintenance responsibilities for field equipment will be assigned to the TRC Field Team Manager. Field personnel will be responsible for daily field checks and for reporting any problems with the equipment. The maintenance schedule will follow the manufacturer's recommendations. Field personnel will also be responsible for ensuring that critical parts are included with the field equipment. Critical spare parts will be immediately available to reduce potential downtime. The inventory will primarily contain parts that are subject to frequent failure, have limited useful lifetimes, and/or cannot be obtained in a timely manner. Backup equipment will be available within 1-day shipment to avoid delays in the field schedule.

9.5 Field Analytical Method Requirements

This section describes the analytical techniques that will be used in the field to generate screening data.

9.5.1 Field Analytical Methods and SOPs

Methods applicable to field analyses for this investigation are summarized in Worksheet #23.

9.5.2 Field Analytical Instrument Calibration

Worksheet #22 provides information relative to the calibration of all field instruments.

All materials, including standards or standard solutions, will be dated upon receipt, and will be identified by material name, lot number, purity or concentration, supplier, recipient's name, and expiration date. All materials must be National Institute of Standard and Technology (NIST)-traceable reference materials.

9.5.2.1 Organic Vapor Detection Instrument

An FID or PID will be used for VOC screening of soil samples. Prior to daily field operations, the instrument will be checked for electronic calibration and adjusted as necessary. A 100 ppmV methane standard (for the FID) and a 100 ppmV isobutylene standard (for the PID) will be used for establishing instrument settings. If non-compliant instrument performance is noted, the instrument will be checked following the manufacturer's troubleshooting procedures. Instrument-specific calibration and maintenance (if needed) and records will be stored by the TRC Field Team Manager.

9.5.2.2 pH/Conductivity/Temperature/DO/ORP/Trubidity/Salinity Measurements

A Horiba® water quality meter, or equivalent, equipped with an in-line flow-through cell for continuous monitoring, will be utilized to determine pH, temperature, conductivity, dissolved

oxygen (DO), salinity and ORP measurements in conjunction with water quality sample collection. The Lamotte 2020 Turbidimeter, or equivalent, will be used to determine turbidity in conjunction with water quality sample collection.

The instruments will be calibrated prior to each day's operation using NIST-traceable reference materials and when the instrument exhibits erratic readings. Calibration data including reference material and dates of reference material preparation and expiration, and the true value observed will be recorded in the field logbook.

If calibration verification standard recovery is determined to be outside the acceptance criteria, the specific probe will be reconditioned and recalibrated or replaced.

9.5.3 Field Analytical Instrument/Equipment Maintenance, Testing and Inspection Requirements

This section describes the procedures and documentation activities that will be performed to ensure that all field analytical instrumentation and equipment are available and in working order when needed. Worksheet #22 summarizes the field analytical instrument maintenance, testing, and inspection requirements. Instrument maintenance logs must be kept and instrumentation must be checked prior to use. The field instrument preventative maintenance program is designed to ensure the effective completion of the sampling effort and to minimize instrument downtime. The maintenance responsibilities for field instruments will be assigned to the TRC Field Team Manager. Field personnel will be responsible for daily field checks and calibrations and for reporting any problems with the instruments. The maintenance schedule will follow the manufacturer's recommendations. Field personnel will also be responsible for ensuring that critical parts are included with the field instruments. Critical spare parts will be immediately available to reduce potential downtime. The inventory will primarily contain parts that are subject to frequent failure, have limited useful lifetimes, and/or cannot be obtained in a timely manner.

Backup instruments and equipment will be available within 1-day shipment to avoid delays in the field schedule.

9.5.4 Field Analytical Inspection and Acceptance Requirements for Supplies/Sample Containers

Critical supplies and sample containers will be inspected in the following manner.

Critical Supplies and Consumables	Inspection Requirements and Acceptance Criteria	Responsible Individual
Sample bottles	Visually inspected upon receipt for cracks, breakage, cleanliness. Must be accompanied by certificate of analysis.	Field Team Manager
Chemicals and	Visually inspected for proper labeling, expiration	Field Team

Critical Supplies and Consumables	Inspection Requirements and Acceptance Criteria	Responsible Individual
reagents	dates, appropriate grade Record lot numbers of reagents used for calibration.	Manager

Supplies and consumables not meeting acceptance criteria will result in the initiation of the appropriate corrective action. Corrective measures may include notification of vendor and subsequent replacement of defective or inappropriate materials. All actions will be documented in the project files.

QAPP Worksheet #19

Analytical SOP Requirements Table

Matrix	Analytical Group	Conc. Level	Analytical and Preparation Method/ SOP Reference[1]	Sample Volume	Containers (Number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Soil	TCL VOCs	High	L-1	2 x 5g	2 x 5g EnCore® samplers	Sealed in EnCore® bag; Cool, 4ºC	48 hours to extract in 5 mL methanol; 14 days to analysis
Soil	TCL SVOCs	Low	L-2	1 x 4 oz	1 x 4 oz. glass bottle	Cool, 4ºC	14 days to extraction; 40 days from extraction to analysis
Soil	TCL Pesticides	Low	L-3	1 x 4 oz	1 x 4 oz. glass bottle	Cool, 4ºC	14 days to extraction; 40 days from extraction to analysis
Soil	PCB Aroclors	Low	L-4	1 x 4 oz	1 x 4 oz. glass bottle	Cool, 4ºC	14 days to extraction; 40 days from extraction to analysis
Soil	TAL Metals	Low	L-5	1 x 4 oz	1 x 4 oz. glass bottle	Cool, 4ºC	Mercury: 28 days to analysis Other metals: 180 days to analysis
Soil	Vanadium and Chromium	Low	L-5	1 x 4 oz	1 x 4 oz. glass bottle	Cool, 4ºC	180 days to analysis
Soil	pH	NA	L-9	1 x 4 oz	1 x 4 oz. glass bottle	Cool, 4ºC	48 hours to analysis
Soil	ORP	NA	L-11	1 x 4 oz	1 x 4 oz. glass bottle	Cool, 4ºC	48 hours to analysis
Soil	Hexavalent Chromium	Low	L-10	1 x 4 oz	1 x 4 oz. glass bottle	Cool, 4ºC	30 days to digestion; 7 days from digestion to analysis
Surface Water	TCL VOCs	Low	L-1	3 x 40 mL	3 x 40 mL VOA vials	HC1 to pH <2; Cool, 4ºC	14 days to analysis
Surface Water	TAL Metals (total and dissolved)	Low	L-5	1 x 500 mL	1 x 500 mL polyethylene bottle	HNO_3 to pH <2; Cool, 4ºC	Mercury: 28 days to analysis Other Metals: 180 days to analysis

QAPP Worksheet #19

Analytical SOP Requirements Table

Matrix	Analytical Group	Conc. Level	Analytical and Preparation Method/ SOP Reference[1]	Sample Volume	Containers (Number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Surface Water	Aluminum, Cadmium, Cobalt, Copper, Selenium, Vanadium (total and dissolved)	Low	L-8	1 x 500 mL	1 x 500 mL polyethylene bottle	HNO_3 to pH <2; Cool, 4ºC	180 days to analysis
Surface Water	Hexavalent Chromium (total and dissolved)	Low	L-10	1 x 1 L	1 x 1 L polyethylene	pH > 12 with NaOH; Cool, 4ºC	24 hours to analysis
Surface Water	Hardness	Low	L-12	1 x 500 mL	1 x 500 mL polyethylene bottle	HNO_3 to pH <2; Cool, 4ºC	180 days to analysis
Sediment	TCL SVOCs	Low	L-2	1 x 4 oz	1 x 4 oz. glass bottle	Cool, 4ºC	14 days to extraction; 40 days from extraction to analysis
Sediment	TCL Pesticides	Low	L-3	1 x 4 oz	1 x 4 oz. glass bottle	Cool, 4ºC	14 days to extraction; 40 days from extraction to analysis
Sediment	PCB Aroclors	Low	L-4	1 x 4 oz	1 x 4 oz. glass bottle	Cool, 4ºC	14 days to extraction; 40 days from extraction to analysis
Sediment	Total Organic Carbon	NA	L-6	1 x 4 oz	1 x 4 oz. glass bottle	Cool, 4ºC	14 days to analysis
Sediment	TAL Metals	Low	L-5	1 x 4 oz	1 x 4 oz. glass bottle	Cool, 4ºC	Mercury: 28 days to analysis Other metals: 180 days to analysis
Sediment	Grain Size	NA	L-7	1 x 8 oz.	1 x 8 oz. clear wide mouth glass	None	None
Sediment	pH	NA	L-9	1 x 4 oz	1 x 4 oz. glass bottle	Cool, 4ºC	48 hours to analysis

QAPP Worksheet #19

Analytical SOP Requirements Table

Matrix	Analytical Group	Conc. Level	Analytical and Preparation Method/ SOP Reference[1]	Sample Volume	Containers (Number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Tissue (aquatic vegetation, aquatic invertebrate, terrestrial invertebrate)	Metals	Low	L-8, L-13	1 x 4 oz	1 x 4 oz. glass bottle	Cool, 4ºC	Mercury: 28 days to analysis Other metals: 180 days to analysis

NA – Not applicable
[1]Laboratory SOPs are included in Appendix E.

QAPP Worksheet #20-1: Soil: RI

Field and Quality Control Sample Summary Table

Matrix	Analytical Group	Conc. Level	Analytical Method/ SOP Reference	No. of Samples	No. of Field Duplicate Pairs	Organic		Inorganic		No. of Trip Blanks	No. of Bottle Blanks	No. of Equip. Blanks	No. of PE Samples	Total No. of Samples to Lab
						No. of MS	No. of MSD	No. of Duplicates	No. of MS					
Soil	TCL VOCs	High	L-1	15	2	2	2	0	0	0	0	0	0	21
Soil	TAL Metals	Low	L-5	19	1	0	0	2	2	0	0	1	0	25
Soil	pH	NA	L-9	28	2	0	0	2	0	0	0	0	0	32
Soil	Hexavalent Chromium	Low	L-10	24	1	0	0	1	1	0	0	1	0	28
Soil	Vanadium	Low	L-5	8	1	0	0	1	1	0	0	1	0	12
Soil	ORP	NA	L-11	24	1	0	0	1	0	0	0	0	0	26

QAPP Worksheet #20-2: Sediment: RI

Field and Quality Control Sample Summary Table

Matrix	Analytical Group	Conc. Level	Analytical Method/ SOP Reference	No. of Samples	No. of Field Duplicate Pairs	Organic		Inorganic		No. of Trip Blanks	No. of Bottle Blanks	No. of Equip. Blanks	No. of PE Samples	Total No. of Samples to Lab
						No. of MS	No. of MSD	No. of Duplicates	No. of MS					
Sediment	TCL SVOCs	Low	L-2	21	2	2	2	0	0	0	0	1	0	28
Sediment	TCL Pesticides	Low	L-3	21	2	2	2	0	0	0	0	1	0	28
Sediment	PCB Aroclors	Low	L-4	21	2	2	2	0	0	0	0	1	0	28
Sediment	TAL Metals	Low	L-5	27	2	0	0	2	2	0	0	2	0	35
Sediment	Total Organic Carbon	NA	L-6	27	2	0	0	2	2	0	0	0	0	33
Sediment	Grain Size	NA	L-7	27	2	0	0	0	0	0	0	0	0	29
Sediment	pH	NA	L-9	27	2	0	0	2	0	0	0	0	0	31

NA-Not applicable

QAPP Worksheet #20-3: Stream Bank Soil Samples: RI

Field and Quality Control Sample Summary Table

Matrix	Analytical Group	Conc. Level	Analytical Method/ SOP Reference	No. of Samples	No. of Field Duplicate Pairs	Organic		Inorganic		No. of Trip Blanks	No. of Bottle Blanks	No. of Equip. Blanks	No. of PE Samples	Total No. of Samples to Lab
						No. of MS	No. of MSD	No. of Duplicates	No. of MS					
Soil	TCL SVOCs	Low	L-2	14	1	1	1	0	0	0	0	1	0	18
Soil	TCL Pesticides	Low	L-3	14	1	1	1	0	0	0	0	1	0	18
Soil	PCB Aroclors	Low	L-4	14	1	1	1	0	0	0	0	1	0	18
Soil	TAL Metals	Low	L-5	14	1	0	0	1	1	0	0	1	0	18
Soil	pH	NA	L-9	14	1	0	0	1	0	0	0	0	0	16
Soil	Hexavalent Chromium	Low	L-10	14	1	0	0	1	1	0	0	1	0	18
Soil	ORP	NA	L-11	14	1	0	0	0	0	0	0	0	0	15

NA-Not applicable

QAPP Worksheet #20-4: Surface Water: RI

Field and Quality Control Sample Summary Table

Matrix	Analytical Group	Conc. Level	Analytical Method/ SOP Reference	No. of Samples	No. of Field Duplicate Pairs	Organic		Inorganic		No. of Trip Blanks	No. of Bottle Blanks	No. of Equip. Blanks	No. of PE Samples	Total No. of Samples to Lab
						No. of MS	No. of MSD	No. of Duplicates	No. of MS					
Surface Water	TCL VOCs	Low	L-1	19	1	1	1	0	0	3	0	0	0	25
Surface Water	TAL Metals-total	Low	L-5	21	2	0	0	2	2	0	0	0	0	27
Surface Water	TAL Metals-dissolved	Low	L-5	21	2	0	0	2	2	0	0	0	0	27
Surface Water	Aluminum, Cadmium, Cobalt, Copper, Selenium, Vanadium-total	Low	L-8	21	2	0	0	2	2	0	0	0	0	27
Surface Water	Aluminum, Cadmium, Cobalt, Copper, Selenium, Vanadium-dissolved	Low	L-8	21	2	0	0	2	2	0	0	0	0	27
Surface Water	Hardness	Low	L-12	21	2	0	0	2	2	0	0	0	0	27
Surface Water	Hexavalent chromium -total	Low	L-10	21	2	0	0	2	2	0	0	0	0	27
Surface Water	Hexavalent chromium-dissolved	Low	L-10	21	2	0	0	2	2	0	0	0	0	27

QAPP Worksheet #20-5: BERA Samples

Field and Quality Control Sample Summary Table

Matrix	Analytical Group	Conc. Level	Analytical Method/ SOP Reference	No. of Samples	No. of Field Duplicate Pairs	Organic		Inorganic		No. of Trip Blanks	No. of Bottle Blanks	No. of Equip. Blanks[1]	No. of PE Samples	Total No. of Samples to Lab
						No. of MS	No. of MSD	No. of Duplicates	No. of MS					
Surface Soil	Chromium, vanadium	Low	L-5	16	1	0	0	1	1	0	0	1	0	20
Sediment	Antimony, barium, beryllium, chromium, copper, lead, mercury, nickel, selenium, vanadium, zinc	Low	L-5	10	1	0	0	1	1	0	0	1	0	14
Aquatic Vegetation	Chromium	Low	L-8	10	0	0	0	1	1	0	0	0	0	12
Aquatic Invertebrates	Antimony, barium, chromium, copper, mercury, vanadium	Low	L-8, L-13	10	0	0	0	1	1	0	0	0	0	12
Terrestrial Invertebrates[2]	Chromium, vanadium	Low	L-8	16	0	0	0	1	1	0	0	0	0	18

[1]Equipment blanks are collected with the surface soil and sediment samples and also apply to the terrestrial invertebrates, aquatic invertebrates, and aquatic vegetation since the same equipment is used in the sampling procedures.
[2]Earthworms may be collected in lieu of terrestrial invertebrates. Refer to Section 9.2.4 of the QAPP for details.

QAPP Worksheet #22

Field Equipment Calibration, Maintenance, Testing and Inspection Table

Sampling Equipment/ Instrument	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person
PID	Calibrate with 100 ppmV isobutylene standard. Blank: zero air check	NA	NA	NA	Daily-before use Calibration check – every 4 hours, at end of day, or if instrument gives erratic results	± 10% of true value	Recalibrate or service; rerun affected sample.	Field Team Manager
	NA	Clean Detector	NA	NA	When unstable readings occur	+ 10% of true value of standard		
	NA	NA	QC Check	NA	See Calibration Frequency	See Calibration Acceptance Criteria		
	NA	NA	NA	Visual Inspection	Daily before use	No defective parts noted		
FID	Calibrate with 100 ppmV methane standard. Blank: zero air check	NA	NA	NA	Daily-before use Calibration check – every 4 hours, at end of day, or if instrument gives erratic results	± 10% of true value	Recalibrate or service; rerun affected sample.	Field Team Manager
	NA	Clean Detector	NA	NA	When unstable readings occur	+ 10% of true value of standard		
	NA	NA	QC Check	NA	See Calibration Frequency	See Calibration Acceptance Criteria		
	NA	NA	NA	Visual Inspection	Daily before use	No defective parts noted		

QAPP Worksheet #22

Field Equipment Calibration, Maintenance, Testing and Inspection Table

Sampling Equipment/ Instrument	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person
Horiba® pH Probe (or equivalent)	Calibrate probe with 3 temperature-equilibrated standards to bracket expected pH values	NA	NA	NA	Daily-before use Calibration check - if instrument gives erratic results	Stable readings ± 0.1 pH units within 3 minutes	If probe reading fails to stabilize, do not use. Check/replace membrane and recalibrate or service as necessary. Repeat analysis of affected samples or qualify data if analysis cannot be repeated.	Field Team Manager
	NA	Clean probe	NA	NA	When unstable readings occur	Stable after 3 minutes	Clear probe; and/or replace membrane, and/or replace or service other defective parts	
	NA	NA	QC Check	NA	See Calibration Frequency	See Calibration Acceptance Criteria		
	NA	NA	NA	Visual Inspection	Daily before use	No defective parts noted		
Horiba® Dissolved Oxygen Probe (or equivalent)	Calibrate with 2 standards – saturated DO standard and 0.0 mg/L DO standard	NA	NA	NA	Daily-before use Calibration check - if instrument gives erratic results	Stable readings ± 0.2 mg/L for 0.0	If DO reading exceeds criterion, then prepare new 0.0 mg/L DO standard, clean probe and/or change membrane. Recalibrate or service as necessary. Repeat analysis of affected samples or qualify data if analysis cannot be repeated.	Field Team Manager

QAPP Worksheet #22

Field Equipment Calibration, Maintenance, Testing and Inspection Table

Sampling Equipment/ Instrument	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person
Horiba® Dissolved Oxygen Probe (or equivalent) (continued)	NA	Clean probe, change KCI and Teflon® membrane	NA	NA	- When bubbles are visible under membrane - When significant deposits of dried electrolyte are visible on membrane or o-ring - When probe give unstable readings	NA	Clear probe; and/or change KCI and replace Teflon® membrane, and/or replace or service	
	NA	NA	QC Check	NA	See Calibration Frequency	See Calibration Acceptance Criteria		
	NA	NA	NA	Visual Inspection	Daily before use	No defective parts noted		
Horiba® Specific Conductance Electrode (or equivalent)	Calibrate electrode with 1 standard close to the expected sample values.	NA	NA	NA	Daily-before use Calibration check - if instrument gives erratic results	$\pm$ 1 umho/cm of standard	If sp. Conductance electrode reading exceeds criterion, then clean probe or service as necessary and recalibrate. Repeat analysis of affected samples or qualify data if analysis cannot be repeated.	Field Team Manager

QAPP Worksheet #22

Field Equipment Calibration, Maintenance, Testing and Inspection Table

Sampling Equipment/ Instrument	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person
Horiba® Specific Conductance Electrode (or equivalent) (continued)	NA	Clear opening to conductivity probe	NA	NA	Prior to initial use	No dirty parts	Clear probe and/or replace or service	
	NA	NA	QC Check	NA	See Calibration Frequency	See Calibration Acceptance Criteria		
	NA	NA	NA	Visual Inspection	Daily before use	No defective parts noted		
Horiba® Temperature Sensor (or equivalent)	Calibrate against NIST-certified thermometer.	NA	NA	NA	Calibration check prior to onset of program	+ 0.15ºC of NIST certified thermometer	If temperature sensor reading exceeds criterion, then clean probe, or service as necessary and recalibrate. Repeat analysis of affected samples or quality data if analysis cannot be repeated.	Field Team Manager
	NA	NA	QC Check	NA	See Calibration Frequency	See Calibration Acceptance Criteria	Replace or Service	
	NA	NA	NA	Visual Inspection	Daily before use	No defective parts noted		

QAPP Worksheet #22

Field Equipment Calibration, Maintenance, Testing and Inspection Table

Sampling Equipment/ Instrument	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person
Horiba® ORP/Eh Probe (or equivalent)	Calibrate against 1 Zobell solution.	NA	NA	NA	Daily-before use Calibration check - if instrument gives erratic results	+ 1 mv of standard	If ORP/Eh reading exceeds criterion, then have manufacturer recalibrate. Repeat analysis of affected samples or qualify data if analysis cannot be repeated.	Field Team Manager
	NA	NA	QC Check	NA	See Calibration Frequency	See Calibration Acceptance Criteria	Manufacture must recalibrate	
	NA	NA	NA	Visual Inspection	Daily before use	No defective parts noted	Replace or service	
Horiba® Salinity Probe (or equivalent)	Performed by manufacturer	NA	NA	NA	Prior to use	NA	NA	Manufacturer
	NA	NA	NA	Visual Inspection	Daily before use	No defective parts noted	Replace or service	Field Team Manager
Turbidimeter	Calibrate with DI water and 1 other standard to bracket expected sample concentration range	NA	NA	NA	Daily-before use Calibration check - if instrument gives erratic results	$\pm$ 5% per scale	If turbidity reading exceeds criterion, then calibrate or service as necessary. Repeat analysis of affected samples or qualify data if analysis cannot be repeated.	Field Team Manager
	NA	NA	QC Check	NA	See Calibration Frequency	See Calibration Acceptance Criteria	Replace or Service	
	NA	NA	NA	Visual Inspection	Daily before use	No defective parts noted		

10.0 ANALYTICAL TASKS

This section of the QAPP describes the analytical techniques that will be used by the fixed laboratories to generate definitive data for the project. It documents the fixed laboratory analytical methods that will be used to meet measurement performance criteria and achieve the project-required quantitation limits for all contaminants of concern and other target compounds in the specific matrices as identified on Worksheets #15-1 through 15-15.

10.1 Fixed Laboratory Analytical Methods and SOPs

Worksheet #23 details the analytical methods that will be used in this investigation. The methods outline the maximum allowable holding times from sample collection to preparation and/or analysis. In addition, the methods detail the required QC checks and QC samples, the required frequencies, QC acceptance limits and required corrective actions. Copies of the laboratory QA manuals are provided in Appendix C of this QAPP.

10.2 Fixed Laboratory Analytical Method/SOP Modifications

In general, the methods will be followed as written. ASTM Method D1498-00, for the analysis of ORP in soil samples, will be modified to include preparation of a soil slurry in accordance with SW-846 Method 9045D.

10.3 Fixed Laboratory Instrument Calibration

Worksheets #24 and 25 detail the calibration procedures associated with all instruments. These calibration procedures ensure that the analytical methods and selected instrumentation meet project requirements for selectivity, sensitivity, accuracy and precision of quantitation. These calibration procedures are also discussed in the analytical methodologies. It should be noted that data used for definitive data require that the quantitation limit be equivalent to the lowest standard used in the initial calibration.

10.4 Fixed Laboratory Instrument/Equipment Maintenance, Testing and Inspection Requirements

This section describes the procedures and documentation activities that will be performed to ensure that all fixed laboratory instrumentation and equipment are available and in good working order when needed. Worksheets #24 and 25 also detail the fixed laboratory instrument maintenance, testing, and inspection requirements. Equipment maintenance logs must be kept and equipment must be checked prior to use.

The maintenance responsibilities for fixed laboratory instruments will be assigned to the Laboratory Section Managers. Laboratory analysts will be responsible for daily checks and calibrations and for reporting any problems with the instruments. The maintenance schedule will follow the manufacturer's recommendations. Laboratory personnel will also be responsible for ensuring that critical parts are kept with the fixed laboratory instruments. Critical spare parts will be immediately available to reduce potential downtime. The inventory will primarily

contain parts that are subject to frequent failure, have limited useful lifetimes, and/or cannot be obtained in a timely manner.

Annual preventative maintenance service visits will involve cleaning, adjusting, inspecting, and testing procedures designed to minimize product failure and/or extend the product's life. Between visits, laboratory analysts will be responsible for performing routine operator maintenance and cleaning in accordance with the manufacturer's specifications.

10.5 Fixed Analytical Inspection and Acceptance Requirements for Supplies/Sample Containers

Critical supplies and sample containers will be inspected in the following manner.

Critical Supplies and Consumables	Inspection Requirements and Acceptance Criteria	Responsible Individual
Sample bottles	Visually inspected upon receipt for cracks, breakage, cleanliness. Must be accompanied by certificate of analysis.	Sample Custodian
Chemicals and reagents	Visually inspected for proper labeling, expiration dates, appropriate grade Record lot numbers of reagents used for standard preparation.	Laboratory Analyst

Supplies and consumables not meeting acceptance criteria will result in the initiation of the appropriate corrective action. Corrective measures may include notification of vendor and subsequent replacement of defective or inappropriate materials. All actions will be documented in the project files.

The use of materials of known purity and quality will be utilized for the calibration of all instruments as part of this project. The laboratories will carefully monitor the use of all laboratory materials including solutions, standards and reagents through well documented procedures.

All solid chemicals and acids/bases used by the laboratories will be reagent grade or better. All gases will be high purity or better. All standards or standard solutions will be obtained from U.S. EPA-certified commercial sources.

All materials including standards or standard solutions will be dated upon receipt, and will be identified by material name, lot number, purity or concentration, supplier, receipt/preparation date, recipient/preparer's name, and expiration date.

Standards or standard solution concentrations will be validated prior to use. This validation may be restandardization for acids and bases, response factor comparison, standard curve response, comparison to other standards made at a different time and/or by a different analyst. All

standards and standard materials will be checked for signs of deterioration including unusual volume changes (solvent loss), discoloration, formation of precipitates or changes in analyte response. All standards and standard solutions will be properly stored and handled and will be labeled with all appropriate information including compound/solution name, concentration, solvent, expiration date, preparation date, and the initials of the preparer.

All solvent materials or materials used as part of a given procedure will also be checked. Each new lot of solvent will be analyzed to ensure the absence of interference.

QAPP Worksheet #23

Analytical SOP References Table

Reference Number	Title, Revision Date and/or Number[1]	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work Y or N
L-1	USEPA. Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry. SW846 Method 8260B, Revision 2. December 1996.	Definitive	VOCs	GC/MS	Accutest Laboratories	N
L-2	USEPA. Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry. SW846 Method 8270D, Revision 4. February 2007. Preparation method: Soil/Sediment: USEPA. Ultrasonic Extraction. SW846 Method 3550C, Revision 3, February 2007.	Definitive	SVOCs	GC/MS	Accutest Laboratories	N
L-3	USEPA. Organochlorine Pesticides by Gas Chromatography. SW846 Method 8081B, Revision 2, February 2007. Preparation method: Soil/Sediment: USEPA. Pressurized Fluid Extraction (PFE). SW846 Method 3545A, Revision 1, February 2007.	Definitive	Pesticides	GC/ECD	Accutest Laboratories	N
L-4	USEPA. Polychlorinated Biphenyls (PCB) by Gas Chromatography. SW846 Method 8082A, Revision 1, February 2007. Preparation method: Soil/Sediment: USEPA. Pressurized Fluid Extraction (PFE). SW846 Method 3545A, Revision 1, February 2007.	Definitive	PCB Aroclors	GC/ECD	Accutest Laboratories	N

QAPP Worksheet #23

Analytical SOP References Table

Reference Number	Title, Revision Date and/or Number[1]	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work Y or N
L-5	USEPA. Inductively Coupled Plasma-Atomic Emission Spectrometry. SW846 Method 6010C, Revision 3, February 2007. USEPA. Mercury in Solid or Semisolid Waste (Manual Cold-Vapor Technique). SW846 Method 7471B, Revision 2. February 2007. USEPA. Mercury in Liquid Waste (Manual Cold-Vapor Technique). SW846 Method 7470A, Revision 1. September 1994. Preparation methods: Surface Water: USEPA. Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by FLAA or ICP Spectroscopy. SW846 Method 3010A, Revision 1. July 1992. Soil/Sediment: USEPA. Acid Digestion of Sediments, Sludges, and Soils. SW846 Method 3050B, Revision 2. December 1996.	Definitive	Metals	ICP/AES, CVAA	Accutest Laboratories	N
L-6	USEPA. Total Organic Carbon. SW846 Method 9060A, Revision 1. November 2004.	Definitive	TOC	Elemental Analyzer	Accutest Laboratories	N
L-7	ASTM. Standard Test Method for Particle-Size Analysis of Soils, Method D422-63, 2002.	Definitive	Grain Size	NA	Accutest Laboratories	N

QAPP Worksheet #23

Analytical SOP References Table

Reference Number	Title, Revision Date and/or Number[1]	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work Y or N
L-8	USEPA. Inductively Coupled Plasma-Mass Spectrometry. SW846 Method 6020A, Revision 1, January 1998. Preparation method: Tissue: USEPA. Microwave Assisted Acid Digestion of Sediments, Sludges, Soils, and Oils, SW846 Method 3051A, Revision 1, February 2007. Surface Water: USEPA. Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by GFAA Spectroscopy. SW846 Method 3020A, Revision 1. July 1992.	Definitive	Select Metals	ICP/MS	Alpha Analytical Laboratory	N
L-9	USEPA. Soil and Waste pH. SW846 Method 9045D, Revision 4. November 2004.	Definitive	pH	pH Meter	Accutest Laboratories	N
L-10	USEPA. Chromium, Hexavalent (Colorimetric). SW846 Method 7196A, Revision 1. July 1992. Preparation method: Surface water: Not applicable; included in SW846 Method 7196A Soil: USEPA. Alkaline Digestion for Hexavalent Chromium. SW846 Method 3060A, Revision 1. December 1996.	Definitive	Hexavalent Chromium	Spectrophotometer	Accutest Laboratories	N
L-11	ASTM. Standard Practice Oxidation-Reduction Potential of Water. ASTM D1498-00.	Definitive	ORP	ORP Probe	Accutest Laboratories	Y[2]
L-12	Standard Methods for the Examination of Water and Wastewater. 19th Edition. Method 2340C, Hardness as CaCO3 by Titration.	Definitive	Hardness	Titration	Accutest Laboratories	N

QAPP Worksheet #23

Analytical SOP References Table

Reference Number	Title, Revision Date and/or Number[1]	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work Y or N
L-13	Tissue: USEPA. Mercury in Sediment and Tissue Samples by Atomic Fluorescence Spectrometry. SW846 Method 7474, Revision 0. February 2007	Definitive	Mercury	Atomic Fluorescence Spectrometer	Alpha Analytical Laboratory	N
F-1	NJDEP Manual	Screening	VOCs	PID or FID	TRC Environmental	N
F-2	NJDEP Manual	Definitive	pH, DO, temperature, specific conductance, ORP, turbidity, salinity	Horiba U-22 (or equivalent)	TRC Environmental	N

[1]Laboratory SOPs and Field Screening Procedures are included in Appendix E.
[2]Modified to include preparation of soil slurry in accordance with SW-846 Method 9045D (L-9).
GC/MS – Gas Chromatograph/Mass Spectrometer; ICP/AES – Inductively Coupled Plasma/Atomic Emission Spectrometer; CVAA – Cold Vapor Atomic Absorption.
NA – Not Applicable

QAPP Worksheets #24 and 25

Analytical Instrument Calibration, Equipment Maintenance, Testing and Inspection Table

Instrument	Activity	List Maintenance, Testing and Inspection Activities	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	Method/SOP Reference
GC/MS	VOC and SVOC Analysis (see L-1 and L-2)	Daily: Check connections, replace disposables, perform injection port maintenance, and clip column. Perform leak checks as needed	Initial: After instrument set up and when calibration verification fails; minimum 5 points	%RSD <30 for CCCs and minimum RF for SPCCs	Perform necessary equipment maintenance and check calibration standards	GC/MS Analysts: Accutest Laboratories	L-1, L-2
			Continuing: Daily prior to samples and every 12 hours	% D < 20 for CCCs and minimum RF for SPCCs	Perform necessary equipment maintenance and check calibration standards		
GC/ECD	Pesticide and PCB Aroclor Analysis (see L-3 and L-4)	Daily: Check connections, replace disposables, perform injection port maintenance, and clip column. Perform leak checks and clean detector as needed.	Initial: After instrument set up and when calibration verification fails; minimum 5 points or 6 points (non-linear)	%RSD < 20 or r $\geq$ 0.995	Perform necessary equipment maintenance and check calibration standards	GC/ECD Analysts: Accutest Laboratories	L-3, L-4
			Continuing: Daily prior to samples and after every 10 samples or every 12 hours, whichever is more frequent	%D $\leq$ 15;	Perform necessary equipment maintenance and check calibration standards		

QAPP Worksheets #24 and 25

Analytical Instrument Calibration, Equipment Maintenance, Testing and Inspection Table

Instrument	Activity	List Maintenance, Testing and Inspection Activities	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	Method/SOP Reference
ICP-AES, CVAA, Atomic Fluorescence	Metals Analysis (see L-5 and L-13)	ICP: Check argon tank pressure, check tubing and nebulizer daily, clean plasma torch assembly as needed, clean filters as needed, check o-rings daily CVAA: Inspect pump windings daily, rotate and replace if necessary, check gases. Atomic Fluorescence: Inspect pump tubing for signs of wear daily and replace monthly or more frequently, if needed. Clean glass liquid separator when glass appears coated with yellow film. Replace dryer tube annually.	Initial Calibration: ICP: One standard and a blank; daily prior to samples CVAA: Daily prior to samples; 5 standards and blank Atomic Fluorescence: Daily prior to samples; 3 standards and blank	None for ICP CVAA and Atomic Fluorescence: $r \geq 0.995$	Perform necessary equipment maintenance and check calibration standards	Metals Analyst: L-5: Accutest Laboratories L-13: Alpha Analytical Laboratory	L-5, L-13
			Initial Calibration Verification: Daily prior to samples	90-110% of true value	Perform necessary equipment maintenance and check calibration standards		
			Continuing Calibration Verification: Every 10 samples or 2 hours, whichever is more frequent, and at end of analytical run	90-110% of true value for ICP and Atomic Fluorescence; 80-120% of true value for CVAA	Perform necessary equipment maintenance and check calibration standards		
Elemental Analyzer	TOC Analysis (see L-6)	Replace catalyst as needed. Check for leaks and replace o-rings as necessary. Replace injection needle as necessary.	Initial: Monthly; five standards and blank	$r \geq 0.995$	Perform necessary equipment maintenance and check calibration standards	TOC Analyst: Accutest Laboratories	L-6
			Continuing: Prior to sample analysis, every 10 samples or 2 hours, whichever is more frequent, and at the end of the sequence	$\pm$ 10% of true value	Perform necessary equipment maintenance and check calibration standards		

QAPP Worksheets #24 and 25

Analytical Instrument Calibration, Equipment Maintenance, Testing and Inspection Table

Instrument	Activity	List Maintenance, Testing and Inspection Activities	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	Method/SOP Reference
ICP/MS	Metals Analysis (see L-8)	Clean nebulizer as needed, check pump tubing daily, replace disposables as needed, check torch alignment	Initial: Daily, every 24 hours or every time instrument is set up	$r \geq 0.995$	Perform necessary equipment maintenance and check calibration standards	ICP/MS Analyst: Alpha Analytical Laboratory	L-8
			Initial Calibration Verification: immediately after initial calibration	90-110% of true value	Perform necessary equipment maintenance and check calibration standards		
			Continuing Calibration Verification: after every 10 samples or every 2 hours, whichever is more frequent	90-110% of true value	Perform necessary equipment maintenance and check calibration standards		
pH Meter	pH	Condition probe when fluctuations occur.	Prior to sample analysis and every 10 samples, minimum of two points > 3 pH units or more apart	Within 0.2 pH units of the true value	Perform necessary equipment maintenance and check calibration standards	Wet Chemistry Analyst: Accutest Laboratories	L-9
Spectrophotometer	Hexavalent Chromium Analysis (see L-10)	Inspect outer and inner chamber for cleanliness daily, check tubing daily, check flow of reagents daily, calibrate by outside vendor annually.	Initial: Prior to sample analysis	$r \geq 0.995$	Perform necessary equipment maintenance and check calibration standards	Wet Chemistry Analyst: Accutest Laboratories	L-10
			Continuing Calibration: After every 10 samples and at end of analytical run	80-120% of true value	Perform necessary equipment maintenance and check calibration standards		

QAPP Worksheets #24 and 25

Analytical Instrument Calibration, Equipment Maintenance, Testing and Inspection Table

Instrument	Activity	List Maintenance, Testing and Inspection Activities	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	Method/SOP Reference
ORP Probe	ORP	Condition probe when fluctuations occur.	Initial Calibration Verification:	90-110% of true value	Perform necessary equipment maintenance and check calibration standards	Wet Chemistry Analyst: Accutest Laboratories	L-11
			Continuing Calibration Verification: after every 10 samples and at end of analytical run	90-110% of true value	Perform necessary equipment maintenance and check calibration standards		

NA – Not Applicable

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11.0 SAMPLE COLLECTION DOCUMENTATION, HANDLING, TRACKING AND CUSTODY PROCEDURES

11.1 Sample Collection Documentation

This section of the QAPP describes field documentation procedures that will be followed for this project. Records of field data will be made throughout the project to document critical data that might be needed at a later time, such as during preparation of the report, or for use by other investigators who were not present when the data were collected.

Field data will be recorded on the following logs, forms, and/or notebooks.

- Daily Personnel Logs
- Field Notebooks
- Field Data Forms
- Photographs
- Equipment Calibration Logs
- Health and Safety Logs

The TRC Field Team Manager has the responsibility to maintain the various logs, forms, and notebooks that document daily field activities as discussed below. Individual responsibilities will be delegated to other field staff, as appropriate. Special emphasis will be placed on the completeness and accuracy of all information recorded in the field, and will contain statements that are legible, accurate, and include documentation of project activities. Because the logbooks, field data forms, and chain-of-custody forms provide the basis for future reports, they must contain accurate facts and observations. The language used in recording all field data will be objective, factual, and free of personal interpretations or other terminology that may prove inappropriate.

The following sections describe how data collected in the field will be documented, tracked, and controlled.

Daily Personnel Log

A log will be maintained to record the identities of all personnel who are on-site for the duration of the project. The log will record the following information.

- Names of field personnel
- Names of subcontractor personnel
- Names of visitors
- Affiliation of field personnel
- Time of entry and exit.

Field Logbooks

Field logbooks will provide the means of recording the chronology of data collection activities performed during the investigation. As such, entries will be described in as much detail as possible so that a particular situation could be reconstructed without reliance on memory.

Field logbooks will be bound field survey books or notebooks. Logbooks will be assigned to field personnel, but will be stored in the project files when not in use. Each logbook will be identified by the project-specific document number. All logbooks will be water resistant and have sequentially numbered pages.

The title page of each logbook will contain the following:

- Person to whom the logbook is assigned,
- The logbook number,
- Project name and number,
- Site name and location,
- Site location by longitude and latitude, if known,
- Project start date, and
- End date.

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date, start time, weather, and names of all sampling team members present will be entered. Each page of the logbook will be signed and dated by the person making the entry. All entries will be made in permanent ink, signed, and dated and no erasures or obliterations will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark which is signed and dated by the sampler. The correction shall be written adjacent to the error.

Field activities will be fully documented. Information included in the logbook will include, but may not be limited to,

- Chronology of activities, including entry and exit times,
- Names of all people involved in sampling activities and organizational affiliations,
- Level of personal protection used,
- Any changes made to planned protocol,
- Names of visitors to the site during sampling and reason for their visit,
- Sample location and identification,
- Weather conditions, including temperature and relative humidity,
- Dates (month/day/year) and times (military) of sample collection,
- Measurement equipment identification (model/manufacturer) and calibration information,
- Field screening results,
- Site observations,
- Sample collection methods and equipment,
- Sample collection date and time,
- Sample depths,
- Whether grab or composite sample collected,

- How sample composited, if applicable,
- Sample description (color, odor, texture, etc.),
- Sample identification code,
- Tests or analyses to be performed,
- Sample preservation and storage conditions,
- Equipment decontamination procedures,
- QC sample collection,
- Unusual observations,
- Record of photographs,
- Sketches or diagrams, and
- Signature of person recording the information

Field logbooks will be reviewed on a daily basis by the TRC Field Team Manager. Logbooks will be supported by standardized forms. Examples of the forms are presented in Appendix B.

Separate field logbooks may be issued for each field team or field task in order to preserve a contemporaneous streaming record of each field activity. Each field logbook will be numbered, and a log will be kept denoting the date each notebook was issued, and the field activity corresponding to each notebook.

Upon receipt of the field logbook for a particular activity, the designated person recording the notes will begin recording notes on a new page. The person recording the notes will indicate the date, time, and weather conditions, prior to recording information about the field activity. The field logbook will indicate whether any Field Data Forms are used and the serial numbers of all forms will be recorded for reference. When the designated person recording the notes either relinquishes the field logbook to another team member or turns the book in at the end of the day, the person relinquishing the field logbook will affix a signature and date to the bottom of the last page used. If the page is not complete, a diagonal line will be struck across the blank portion of the page.

Field Data Forms

Appendix B presents example forms that may be used to record basic information from certain common field activities. These forms were designed to minimize the potential for critical data loss from the field. Field personnel are instructed to utilize these forms to record critical data during the field activities for which each form was designed. A stockpile of sequentially numbered blank forms will be kept in the field. As forms are completed, they will be kept in a three-ring notebook in the field. When field work is completed, this notebook will be kept in the office.

As with the field logbooks, all documentation will be recorded in permanent ink. Corrections to errors in documentation or recorded calculations will be made by first striking out the error with a single line so as not to obliterate the original entry. Then the replacement entry or value will be inserted where appropriate. The person originating the change will initial and date each separate change. All revisions, deletions, and changes will be made in indelible ink.

Photographs

Field personnel will be instructed to photo-document field activities where possible. Examples of items that may require photographic documentation include:

- General site topography
- Sampling locations
- Existing monitoring locations
- Physical appearance of soil, surface water, sediment, aquatic vegetation, aquatic invertebrates, terrestrial invertebrates, and earthworms

A field logbook entry or Photograph Log will be used to record the date and time of all photographs taken at the site.

Equipment Calibration Log

A field logbook entry or daily log will be used to record which instruments were calibrated each day (identified by manufacturer, model number and serial number), the individual who performed the calibration, and any notes regarding the maintenance of the instrument.

Health and Safety

Health and safety procedures and documentation will follow the OU1 and OU2 Health and Safety Plan. A field logbook entry or a Health and Safety Log will be used to record any Health and Safety issues that arise during field activities. Any injuries, illnesses, use of first aid supplies, use of personal protective equipment (for levels A, B or C only, if needed), or possible work-related symptoms will be recorded in the log together with the date, the name(s) of the affected individual(s), and a description of the incident.

11.2 Field Documentation Management System

The TRC Field Team Manager will maintain an inventory of all logbooks used during the program and will be responsible for ensuring that they are archived in the project files following the completion of the investigation.

Completed standardized forms will be maintained by the TRC Field Team Manager during the duration of the program and will be archived in the project files following completion of the sampling effort.

11.2.1 Sample Handling and Tracking System

This section documents the procedures that will be followed to identify and track samples collected in the field, samples delivered or shipped to a fixed laboratory for analysis, and sample transfer throughout the laboratory. Worksheet #26 summarizes these procedures.

11.2.2 Sample Identification and Labeling

The establishment of a standard sample designation/labeling protocol is essential to ensure adequate quality assurance/quality control and to allow tracking of each sample and the associated analytical data. Proper labeling allows for the tracking of samples beginning from the time of sample collection, through analysis, and following project completion should future data correlation be deemed necessary. The proper labeling of samples is also critical in ensuring that samples are analyzed within the required sample holding times.

All samples will be identified using a unique sample identification scheme suitable to the project and the sampling protocol. The numbering scheme to be used is presented in Worksheets #18-1 through 18-7. Samples labels will include the following information:

- Site name and designated project number;
- Sampling location;
- Sample matrix (media type);
- Sample identification number;
- Date and time the sample was collected;
- Sample preservation method;
- Sample pH (if appropriate);
- Analytical method requested; and
- Laboratory turnaround (standard or expedited)

The sample identification number will be recorded on the chain-of-custody forms accompanying each sample shipment submitted for analysis and will be recorded in the field logbooks.

11.3 Sample Preservation, Containerization, and Shipping

Summaries of sample containers, required sample volumes, preservation, and holding time requirements for all samples are presented in Worksheet #19.

Samples will be shipped to the laboratory via Federal Express within twenty-four to forty-eight hours of sample collection using the overnight delivery service with coolers under custody seal or via courier service. If analytical holding times are 24 hours-48 hours from time of sample collection or if samples need to be preserved at the laboratory, samples will be shipped or picked up within 24 hours of sample collection using the overnight service or courier service, respectively. Aqueous samples for hexavalent chromium analysis will be picked up using courier service within a few hours of being collected.

11.4 Sample Custody

Custody is one of several factors that are necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field

sample collection, laboratory analysis, and final evidence files. Worksheet #27 summarizes sample custody requirements.

A sample or evidence file is considered to be under a person's custody if

- the item is in the actual possession of a person;
- the item is in the view of the person after being in actual possession of the person;
- the item was in the actual physical possession of the person but is locked up to prevent tampering; and
- the item is in a designated and identified secure area.

11.4.1 Field Sample Custody

Sample handling is an important part of the field investigation program since samples that are incorrectly handled can affect the quality of data. Sample handling begins at the collection of the samples and continues until the sample has been analyzed. An overriding consideration essential for the validation of environmental measurement data is the necessity to demonstrate that samples have been obtained from the locations stated and that they have reached the laboratory without alteration. Evidence of sample tracking from collection to shipment, laboratory receipt, and laboratory custody (until proper sample disposal and the introduction of field investigation results as evidence in legal proceedings when pertinent) must be documented.

Sample chain-of-custody and packaging procedures are summarized below. These procedures will ensure that the samples will arrive at the laboratory with the chain-of-custody intact. The TRC Field Team Manager (or designee) is responsible for overseeing and supervising the implementation of proper sample custody procedures in the field and up until the samples have been transferred to a courier. The chain-of-custody procedures are initiated in the field immediately following sample collection. The procedures consist of: (1) preparing and attaching a unique sample label to each sample collected; (2) completing the chain-of-custody form; and (3) preparing and packing the samples for shipment, as described in more detail below.

- The field sampler is personally responsible for the care and custody of the samples until they are transferred or dispatched properly. Field procedures have been designed such that as few people as possible will handle the samples.

- All bottles will be identified by the use of pre-printed adhesive sample labels with site name and location, sample locations, date/time of collection, type of preservation, type of analysis, and sampler's initials. The sample numbering system is presented in Worksheets #18-1 through 18-7 of this QAPP. Figure 11-1 provides an example sample label.

- Sample labels will be completed for each sample using waterproof ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample label because the pen would not function in wet weather. In addition, with the exception of VOC vials, sample labels will be covered with clear tape to minimize water damage during transit.

- Samples will be transported in containers (coolers) which will maintain the refrigeration temperature for those parameters for which refrigeration is required.

- Samples will be accompanied by a properly completed chain-of-custody form. The sample numbers and locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents the transfer of custody of samples from the sampler to another person, to a mobile laboratory, to the permanent laboratory, or to/from a secure storage location.

- Chain-of-custody records are initiated by the samplers in the field. The field portion of the custody documentation should include: (1) the project name; (2) signatures of samplers; (3) the sample number, date and time of collection, and whether the sample is grab or composite; (4) signatures of individuals involved in sampling; (5) the designation of field duplicate, trip blank and equipment blank samples, and (6) if applicable, air bill or other shipping number.

- All shipments will be accompanied by the chain-of-custody record identifying the contents. The original record will accompany the shipment, and copies will be retained by the sampler and placed in the project files. An example chain-of-custody is included in Figure 11-2.

- Samples will be properly packaged for shipment and dispatched to the laboratory for analysis, with a separate signed custody record enclosed in and secured to the inside top of each sample box or cooler. Shipping containers will be secured for shipment to the laboratory. If an authorized laboratory courier does not pick up the samples from the project site, custody seals will be attached to the front right and back left of the cooler and covered with clear plastic tape after being signed by field personnel. An example of a cooler custody seal is provided in Figure 11-3. Subsequently, the cooler will be strapped shut with strapping tape in at least two locations.

- If the samples are sent by common carrier, the air bill will be used. Air bills will be retained by the laboratory as part of the permanent documentation. Commercial carriers are not required to sign off on the custody forms since the custody forms will be sealed inside the sample cooler and the custody seals will remain intact.

- Samples remain in the custody of the sampler until transfer of custody is completed. This consists of delivery of samples to the laboratory sample custodian, and signature of the laboratory sample custodian on the chain-of-custody document as receiving the samples and signature of sampler as relinquishing samples.

11.4.2 Laboratory Sample Custody

Samples will be received and logged in by a designated sample custodian or his/her designee. Upon sample receipt, the sample custodian will

- Examine the shipping containers to verify that the custody tape is intact,

- Examine all sample containers for damage,
- Determine if the temperature required for the requested testing program has been maintained during shipment and document the temperature on the chain-of-custody or sample login records,
- Compare samples received against those listed on the chain-of-custody,
- Verify that sample holding times have not been exceeded,
- Examine all shipping records for accuracy and completeness,
- Determine sample pH (if applicable) and record on chain-of-custody or sample login forms,
- Sign and date the chain-of-custody immediately (if shipment is accepted) and attach the air bill,
- Note any problems associated with the coolers and/or samples on the cooler receipt form and notify the Laboratory Project Manager, who will be responsible for contacting the TRC Project QA Manager,
- Attach laboratory sample container labels with unique laboratory identification and test, and
- Place the samples in the proper laboratory storage.

Following receipt, samples will be logged in according to the following procedure:

- The samples will be entered into the laboratory tracking system. At a minimum, the following information will be entered: project name or identification, unique sample numbers (both client and internal laboratory), type of sample, required tests, date and time of laboratory receipt of samples, and field identification provided by field personnel.
- The Laboratory Project Manager will be notified of sample arrival.
- The completed chain-of-custody, air bills, and any additional documentation will be placed in the final evidence file.

Figure 11-1 Sample Label

Figure 11-1

Sample Label

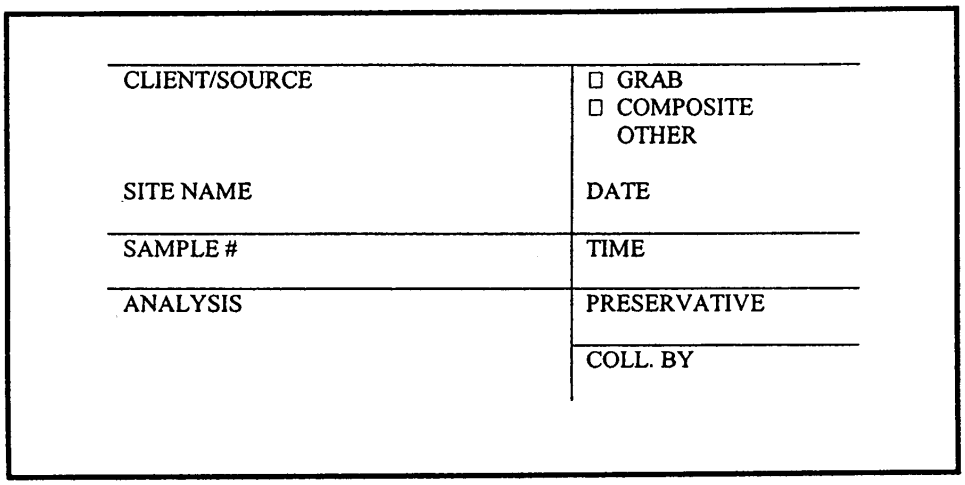


Figure 11-2 Chain-of-Custody

CHAIN OF CUSTODY/REQUEST FOR ANALYSIS

Site Name	Project Manager	Company	Address
		TRC Raviv Associates, Inc.	57 East Willow Street
Site Location	**TRC Job No.**	**City / State**	**Phone / Fax**
		Millburn / New Jersey	973-564-6006 / 973-564-6442

Sample Identification

Lab ID Number (for Lab use only)	Sample Designation	Media (SOIL, GW, LEAC, DW, SED, SW, AIR)	Collection Date	Collection Time (military time)	Sampler's Initials	# of Bottles	Number of Preserved Bottles: None	HCL	NaOH	HNO3	H2SO4	NaHSO4	MEOH	ENCORE

Sample Analysis

PP+40	PHCs - (418.1)	VOCs+10 PPL (GW) - (8260)	VOCs+15 PPL (Soil) - (8260)	BNs+15 PPL - (8270)	ABN+25 PPL (8270) - (8270)	PAHs - (8270)	PP- Metals-(6010B+7471 (GW) 7470(S))	PCBs - (8082)					Comments	Turnaround Time (days)

Special Instructions:

Deliverables: ☐ Full CLP (Level I) ☐ Full Non-CLP (Level II) ☐ NJDEP Electronic Format ☐ Reduced CLP (Level III) ☐ Reduced Non-CLP (Level IV) ☐ TRC Database Format

Project Manager Signature:

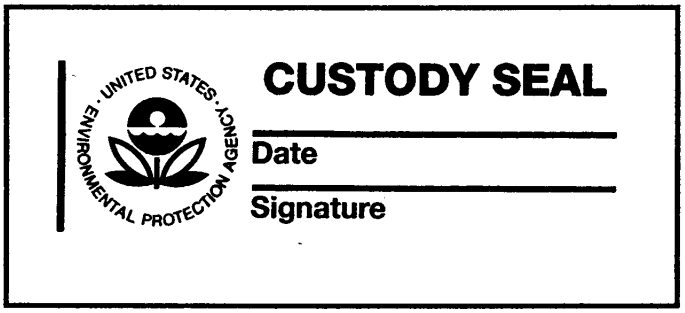
Relinquished by	Company	Date/Time	Received by	Company	Date/Time
1)			1)		
Relinquished by	Company	Date/Time	Received by	Company	Date/Time
2)			2)		

August 2006 Copy of TRC Raviv COC.xls

Figure 11-3 Custody Seal

Figure 11-3

Custody Seal



QAPP Worksheet #26

Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Field Team Manager and Field Staff/TRC
Sample Packaging (Personnel/Organization): Field Team Manager and Field Staff/TRC
Coordination of Shipment (Personnel/Organization): Field Team Manager/TRC
Type of Shipment/Carrier: Federal Express/Courier Service
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Dave Hunkele/Accutest Laboratories, Dianne Janak/Alpha Analytical Laboratory
Sample Custody and Storage (Personnel/Organization): Dave Hunkele/Accutest Laboratories, Dianne Janak /Alpha Analytical Laboratory
Sample Preparation (Personnel/Organization): Laboratory Technicians/Accutest Laboratories, Alpha Analytical Laboratory
Sample Determinative Analysis (Personnel/Organization): Laboratory Analysts/Accutest Laboratories, Alpha Analytical Laboratory
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): 60 days after delivery of data package
Sample Extract/Digestate Storage (No. of days from extraction/digestion): 60 days after delivery of data package
Biological Sample Storage (No. of days from sample collection): 60 days after delivery of data package
SAMPLE DISPOSAL
Personnel/Organization: Laboratory Technicians/Accutest Laboratories, Alpha Analytical Laboratory
Number of Days from Analysis: 60 days after delivery of data package

QAPP Worksheet #27

Sample Custody Requirements

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory): Refer to Section 11.4.1
Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal): Refer to Section 11.4.2 and Worksheet #26
Sample Identification Procedures: Refer to Section 11.2.2 and Worksheets #18-1 through 18-7.
Chain-of-Custody Procedures: Refer to Section 11.4

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12.0 QUALITY CONTROL SAMPLES

12.1 Sampling Quality Control

This section of the QAPP identifies the QC procedures, checks, and samples that will be used to monitor the quality of various aspects of the sampling event. Their required analysis frequency, acceptance limits and corrective actions are also documented in this section of the QAPP. Worksheets #12-1 through 12-12 summarize this information for each matrix, analytical parameter and sampling method. It should be noted that Bottle Blanks are not being submitted for analysis during this investigation. All bottles will be certified clean from the manufacturer and the certifications will be stored in the project file. Potential contaminants due to the sample containers will also be detected in the equipment blanks, as discussed below.

12.1.1 Equipment Blanks

Internal quality control checks will include analysis of equipment blanks to check for procedural contamination at the site that may cause sample contamination. Equipment blanks will be prepared by routing deionized water through sampling equipment after equipment decontamination and before field sample collection. Equipment blanks will be submitted at a frequency of one per twenty samples per matrix and per parameter. It should be noted that equipment blanks will not be collected for the following parameters:

- VOCs in soil due to the lack of equipment used in collection (i.e., limited to EnCore® samplers).
- TOC, pH, and ORP in sediment and/or soil due to the nature of the analysis and intended use of the data.
- Geotechnical parameters associated with sediment samples (e.g., grain size).
- All parameters associated with surface water samples due to the lack of equipment used in collection (i.e., direct filling of sample bottles for each parameter).

12.1.2 Cooler Temperature Blanks

Cooler temperature blanks consist of a sample container filled with non-preserved water (potable or distilled) and are included in all coolers which contain samples which require temperature preservation. The laboratory uses these temperature blanks to ensure that proper preservation of the samples has been maintained during sample shipment. The temperature of these blanks must be 4 ºC ±2º to demonstrate that proper preservation has been maintained. The laboratory records the results of the temperature blanks on the chain-of-custody or sample login form immediately upon receipt of the samples at the laboratory, prior to inventory and refrigeration.

12.1.3 Trip Blanks

For water samples, trip blank samples will be prepared by filling three 40-mL VOA vials with ASTM Type II or equivalent water and preserving the samples with HC1 to a pH <2. Trip blank samples will be submitted to the laboratory with every cooler containing aqueous VOC samples

and will only be analyzed for VOCs. Trip blanks will be used to evaluate contamination introduced during shipment.

12.1.4 Field Duplicates

Field duplicates, or duplicate subsamples, are an additional aliquot of the same sample submitted for the same parameters as the original sample. Field duplicates will be used to assess the sampling and analytical reproducibility. Field duplicates will be collected by alternately filling sample bottles from the source being sampled. Field duplicates will be submitted at a frequency of one per twenty investigative samples, per matrix and analytical parameter. However, field duplicates will not be collected with the aquatic vegetation, aquatic invertebrate, terrestrial invertebrate, and earthworm samples.

12.2 Analytical Quality Control

This section identifies the QC procedures, checks, and samples, and their respective acceptance limits, that will be used during the project to monitor the quality of various preparatory and analytical steps. Worksheets #28-1 through 28-11 summarize this information for each matrix and analytical parameter where QC procedures are required.

12.2.1 Field Analytical QC

12.2.1.1 Instrument Blanks

Instrument blanks will be performed with the FID/PID monitoring using a zero air gas. VOCs must be below background. The instrument blank must be analyzed on each working day before sample analyses are conducted and when instrument contamination is suspected.

12.2.2 Fixed Laboratory QC

All required QC checks, QC samples and the associated QC acceptance limits are detailed in the associated analytical methods.

12.2.2.1 Method Blanks

Method blanks will be performed as part of each analytical batch for each methodology performed. Method blanks are used to evaluate contamination introduced during sample preparation and/or analysis by the laboratory.

12.2.2.2 Instrument Blanks

Instrument blanks are used to evaluate contamination resulting from the analytical reagents and the instrumentation. In addition, instrument blanks are sometimes used to assess potential carryover after the analysis of a highly contaminated sample. Instrument blanks are only required for select analytical parameters.

12.2.2.3 Matrix Spike Samples

The matrix spike samples are used to determine laboratory preparation and analysis bias for specific compounds in specific matrices (i.e., sample specific QC). Matrix spikes are typically performed at a frequency of one per twenty investigative samples.

12.2.2.4 Surrogate Spikes

Surrogate spikes are used to evaluate extraction efficiency or analytical bias on a sample by sample basis for organic parameters. Surrogate spikes are added to all samples for organic parameters. Surrogate spikes are another measure of sample-specific QC.

12.2.2.5 Laboratory Control Samples

Laboratory control samples (LCSs) are used to evaluate all parameters for the ability of the laboratory to accurately identify and quantitate target compounds in a reference matrix when spiked a known concentration using a secondary source standard. LCSs are typically performed as part of each analytical batch for each methodology. LCSs are also a self-check for the laboratory to ensure the method is in compliance.

12.2.2.6 Laboratory Duplicate

Laboratory duplicates are used to evaluate laboratory preparation and analysis precision. These analyses are typically performed for inorganic parameters only. Laboratory duplicates are typically performed at a frequency of one per twenty samples per matrix.

12.2.2.7 Matrix Spike Duplicate Samples

Matrix spike duplicates (MSDs) are used to evaluate laboratory preparation and analysis bias and precision for specific compounds in specific sample matrices (i.e., sample specific QC). MSDs are typically performed for organic parameters only.

12.2.2.8 Internal Standards

Internal standards are used to assess the analytical accuracy, precision, and stability. Internal standards are typically only used for organic analyses and ICP/MS analyses. Internal standards are spiked into all samples and are considered a sample-specific QC measure.

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QAPP Worksheet #28-1

QC Samples Table

Matrix	Soil
Analytical Group	VOCs
Concentration Level	High
Analytical Method/ SOP Reference	L-1
Sampler's Name	TBD
Field Sampling Organization	TRC
Laboratory Name	Accutest Laboratories
No. of Sample Locations	15

Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Method Blank	One every 12 hours after the continuing calibration standard	No target compounds ≥ QL (except methylene chloride and cyclohexane < 2.5x QL and acetone and 2-butanone < 5xQL)	Reclean, retest, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias-Contamination	No target compounds ≥ QL (except methylene chloride and cyclohexane < 2.5x QL and acetone and 2-butanone < 5xQL)
Reagent Blank	NA	NA	NA	NA	NA	NA
Storage Blank	NA	NA	NA	NA	NA	NA
Instrument Blank	As needed to assess carryover from high concentration samples	No target compounds ≥ QL	Reclean, retest, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias-Contamination	No target compounds ≥ QL
Matrix Spike	One per 20 samples	Percent recoveries as per Worksheet #12-1	Reanalyze and qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries as per Worksheet #12-1
Matrix Spike Duplicates	One per 20 samples	Percent recoveries and RPDs as per Worksheet #12-1	Reanalyze and qualify data	Analyst and Data Validator	Accuracy/bias and Precision	Percent recoveries and RPDs as per Worksheet #12-1
LCS	One per extraction batch	Percent recoveries 70-130%	Determine cause of problem, reanalyze and/or qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 70-130%
Surrogates	3 per sample	Percent recoveries as per Worksheet #12-1	Determine cause of problem, reanalyze and/or qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries as per Worksheet #12-1
Internal Standards (ISs)	3 per sample	Area counts: -50% ±100% of areas in associated continuing calibration standard Retention times: ± 30 seconds from retention times in associated continuing calibration standard	Reanalyze and qualify data	Analyst and Data Validator	Accuracy/bias and Precision	Area counts: -50% ±100% of areas in associated continuing calibration standard Retention times: ± 30 seconds from retention times in associated continuing calibration standard
Cooler Temperature Blank	One per cooler	Cooler temperature 4ºC ± 2º	Contact client and qualify data.	Sample Receipt Personnel and Data Validator	Accuracy/bias	Cooler temperature 4ºC ± 2º

NA = Not Applicable TBD = To Be Determined

QAPP Worksheet #28-2

QC Samples Table

Matrix	Soil/Sediment/Tissue					
Analytical Group	Metals					
Concentration Level	Low					
Analytical Method/ SOP Reference	L-5, L-8, L-13					
Sampler's Name	TBD					
Field Sampling Organization	TRC					
Laboratory Name	L-5 (soil/sediment): Accutest Laboratories L-8, L-13 (tissue): Alpha Analytical Laboratory					
No. of Sample Locations	58 soil; 37 sediment; 36 tissue					
Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Method Blank	One per preparation batch	No target compounds ≥ QL	Reclean, retest, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias-Contamination	No target compounds ≥ QL
Reagent Blank**	ICB: immediately after ICV CCB: every 10 samples immediately after CCV	No target compounds ≥ QL	Reclean, retest, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias-Contamination	No target compounds ≥ QL
Equipment Blank	One per 20 samples per soil and sediment	No target compounds ≥ QL	Qualify data	Data Validator	Accuracy/bias-Contamination	No target compounds ≥ QL
Instrument Blank	NA	NA	NA	NA	NA	NA
Laboratory Duplicate	One per 20 samples	RPD ≤ 35 if results ≥ 5x QL	Qualify data	Analyst and Data Validator	Precision	RPD ≤ 35 if results ≥ 5x QL
Matrix Spike	One per 20 samples	L-5, L-8: Percent recoveries 75-125% L-13: Percent recoveries 80-120%	Qualify data	Analyst and Data Validator	Accuracy/bias	L-5, L-8: Percent recoveries 75-125% L-13: Percent recoveries 80-120%
Matrix Spike Duplicates	NA	NA	NA	NA	NA	NA
LCS	One per batch	L-5, L-8: Within EPA or vendor control limits L-13: Percent recoveries 80-120%	Determine cause of problem, reprep, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias	L-5, L-8: Within EPA or vendor control limits L-13: Percent recoveries 80-120%
Surrogates	NA	NA	NA	NA	NA	NA
Other: Interference Check Sample	Beginning of run or every 8 hours	Percent recoveries 80-120%	Recalibrate and reanalyze and/or qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 80-120%

QAPP Worksheet #28-2

QC Samples Table

Matrix	Soil/Sediment/Tissue					
Analytical Group	Metals					
Concentration Level	Low					
Analytical Method/ SOP Reference	L-5, L-8, L-13					
Sampler's Name	TBD					
Field Sampling Organization	TRC					
Laboratory Name	L-5 (soil/sediment): Accutest Laboratories L-8, L-13 (tissue): Alpha Analytical Laboratory					
No. of Sample Locations	58 soil; 37 sediment; 36 tissue					
Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Other: Serial Dilution	One per 20 samples	Within 10% of original determination	Qualify data	Analyst and Data Validator	Accuracy/bias	Within 10% of original determination
Other: QL Check Standard	Beginning and end of analytical sequence	Percent recoveries 70-130% (50-150% for cobalt, manganese, and zinc)	Recalibrate and reanalyze and/or qualify data	Analyst and Data Validator	Sensitivity and Accuracy/bias	Percent recoveries 70-130% (50-150% for cobalt, manganese, and zinc)
Internal Standards (ISs) (ICP/MS only)	Every sample	30-120% of IS in calibration standard	Dilute sample 5x, add IS and reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias	30-120% of IS in calibration standard
Cooler Temperature Blank	One per cooler	Cooler temperature 4ºC $\pm$ 2º	Contact client and qualify data.	Sample Receipt Personnel and Data Validator	Accuracy/bias	Cooler temperature 4ºC $\pm$ 2º

** Also referred to as initial and continuing calibration blanks. NA = Not Applicable TBD = To Be Determined

QAPP Worksheet #28-3

QC Samples Table

Matrix	Soil/Sediment					
Analytical Group	SVOCs					
Concentration Level	Low					
Analytical Method/ SOP Reference	L-2					
Sampler's Name	TBD					
Field Sampling Organization	TRC					
Laboratory Name	Accutest Laboratories					
No. of Sample Locations	14 soil; 21 sediment					
Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Method Blank	One every extraction batch	No target compounds ≥ QL (except phthalates must be ≤ 5x QL)	Reclean, retest, re-extract, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias-Contamination	No target compounds ≥ QL (except phthalates must be ≤ 5x QL)
Equipment Blank	One per 20 samples per soil and sediment	No target compounds ≥ QL (except phthalates must be ≤ 5x QL)	Qualify data	Data Validator	Accuracy/bias-Contamination	No target compounds ≥ QL (except phthalates must be ≤ 5x QL)
Storage Blank	NA	NA	NA	NA	NA	NA
Instrument Blank	As needed to assess carryover from high concentration samples	No target compounds ≥ QL (except phthalates must be ≤ 5x QL)	Reclean, retest, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias-Contamination	No target compounds ≥ QL (except phthalates must be ≤ 5x QL)
Laboratory Duplicate	NA	NA	NA	NA	NA	NA
Matrix Spike	One per 20 samples	Percent recoveries as per Worksheet #12-2	Reanalyze and qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries as per Worksheet #12-2
Matrix Spike Duplicates	One per 20 samples	Percent recoveries and RPDs as per Worksheet #12-2	Reanalyze and qualify data	Analyst and Data Validator	Accuracy/bias and Precision	Percent recoveries and RPDs as per Worksheet #12-2
Surrogates	6 per sample	Percent recoveries as per Worksheet #12-2	Re-extract and reanalyze as and qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries as per Worksheet #12-2
LCS	One per extraction batch	Percent recoveries 40-140%	Determine cause of problem, re-extract, reanalyze and/or qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 40-140%
Internal Standards (ISs)	6 per sample	Area counts: -50% ±100% of areas in associated continuing calibration standard Retention times: ± 30 seconds from retention times in associated continuing calibration standard	Reanalyze and qualify data	Analyst and Data Validator	Accuracy/bias and Precision	Area counts: -50% ±100% of areas in associated continuing calibration standard Retention times: ± 30 seconds from retention times in associated continuing calibration standard
Cooler Temperature Blank	Cooler Temperature Blank	One per cooler	Cooler temperature 4ºC ± 2º	Contact client and qualify data.	Sample Receipt Personnel and Data Validator	Cooler temperature 4ºC ± 2º

NA = Not Applicable
TBD = To Be Determined

QAPP Worksheet #28-4

QC Samples Table

Matrix	Soil/Sediment					
Analytical Group	Pesticides					
Concentration Level	Low					
Analytical Method/ SOP Reference	L-3					
Sampler's Name	TBD					
Field Sampling Organization	TRC					
Laboratory Name	Accutest Laboratories					
No. of Sample Locations	14 soil; 21 sediment					
Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Method Blank	One every extraction batch	No target compounds $\geq$ QL	Reclean, retest, re-extract, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias-Contamination	No target compounds $\geq$ QL
Equipment Blank	One per 20 samples per soil and sediment	No target compounds $\geq$ QL	Qualify data	Data Validator	Accuracy/bias-Contamination	No target compounds $\geq$ QL
Storage Blank	NA	NA	NA	NA	NA	NA
Instrument Blank	Every 12 hours after initial calibration or calibration verification	No target compounds $\geq$ ½ QL	Reclean, retest, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias-Contamination	No target compounds $\geq$ ½ QL
Laboratory Duplicate	NA	NA	NA	NA	NA	NA
Matrix Spike	One per 20 samples	Percent recoveries as per Worksheet #12-4	Reanalyze and qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries as per Worksheet #12-4
Matrix Spike Duplicates	One per 20 samples	Percent recoveries as per Worksheet #12-4	Reanalyze and qualify data	Analyst and Data Validator	Accuracy/bias and Precision	Percent recoveries as per Worksheet #12-4
LCS	One per extraction batch	Percent recoveries 40-140%	Determine cause of problem, re-extract, reanalyze and/or qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 40-140%
Surrogates	2 per sample	Percent recoveries as per Worksheet #12-4	As specified in method and qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries as per Worksheet #12-4
Internal Standards (ISs)	NA	NA	NA	NA	NA	NA
Cooler Temperature Blank	One per cooler	Cooler temperature 4ºC $\pm$ 2º	Contact client and qualify data.	Sample Receipt Personnel and Data Validator	Accuracy/bias	Cooler temperature 4ºC $\pm$ 2º
Other: Endrin\DDT Breakdown	Every 12 hours	Percent breakdown $\leq$ 20 for each compound; combined breakdown $\leq$ 30	Perform injection port maintenance, retest, reanalyze and/or qualify data	Analyst and Data Validator	Accuracy/bias	Percent breakdown $\leq$ 20 for each compound; combined breakdown $\leq$ 30

NA = Not Applicable
TBD = To Be Determined

QAPP Worksheet #28-5

QC Samples Table

Matrix	Soil/Sediment					
Analytical Group	PCB Aroclors					
Concentration Level	Low					
Analytical Method/ SOP Reference	L-4					
Sampler's Name	TBD					
Field Sampling Organization	TRC					
Laboratory Name	Accutest Laboratories					
No. of Sample Locations	14 soil; 21 sediment					
Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Method Blank	One every extraction batch	No target compounds $\geq$ QL	Reclean, retest, re-extract, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias-Contamination	No target compounds $\geq$ QL
Equipment Blank	One per 20 samples per soil and sediment	No target compounds $\geq$ QL	Qualify data	Data Validator	Accuracy/bias-Contamination	No target compounds $\geq$ QL
Storage Blank	NA	NA	NA	NA	NA	NA
Instrument Blank	Every 12 hours after initial calibration or calibration verification	No target compounds $\geq$ ½ QL	Reclean, retest, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias-Contamination	No target compounds $\geq$ ½ QL
Laboratory Duplicate	NA	NA	NA	NA	NA	NA
Matrix Spike	One per 20 samples	Percent recoveries as per Worksheet #12-3	Reanalyze and qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries as per Worksheet #12-3
Matrix Spike Duplicates	One per 20 samples	Percent recoveries as per Worksheet #12-3	Reanalyze and qualify data	Analyst and Data Validator	Accuracy/bias and Precision	Percent recoveries as per Worksheet #12-3
LCS	One per extraction batch	Percent recoveries 40-140%	Determine cause of problem, re-extract, reanalyze and/or qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 40-140%
Surrogates	2 per sample	Percent recoveries as per Worksheet #12-3	As specified in method and qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries as per Worksheet #12-3
Internal Standards (ISs)	NA	NA	NA	NA	NA	NA
Cooler Temperature Blank	One per cooler	Cooler temperature 4ºC $\pm$ 2º	Contact client and qualify data.	Sample Receipt Personnel and Data Validator	Accuracy/bias	Cooler temperature 4ºC $\pm$ 2º

NA = Not Applicable
TBD = To Be Determined

QAPP Worksheet #28-6

QC Samples Table

Matrix	Soil/Sediment					
Analytical Group	TOC, pH, and ORP					
Concentration Level	NA					
Analytical Method/ SOP Reference	TOC: L-6 pH: L-9 ORP: L-11					
Sampler's Name	TBD					
Field Sampling Organization	TRC					
Laboratory Name	Accutest Laboratories					
No. of Sample Locations	Sediment: 27 Soil: 46					
Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Method Blank (TOC)	Prior to samples and one per 20 samples	TOC < QL	Reclean, retest, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias-Contamination	TOC < QL
Storage Blank	NA	NA	NA	NA	NA	NA
Instrument Blank	NA	NA	NA	NA	NA	NA
Laboratory Duplicate	TOC: Every sample pH and ORP: One per 20 samples	TOC: RPD $\leq$ 20 pH and ORP: RPD $\leq$ 5	Reanalyze and qualify data	Analyst and Data Validator	Precision	TOC: RPD $\leq$ 20 pH and ORP: RPD $\leq$ 5
Matrix Spike (TOC)	One per 20 samples	Percent recoveries 75-125%	Reanalyze and qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 75-125%
Matrix Spike Duplicates	NA	NA	NA	NA	NA	NA
LCS (TOC)	One per batch	Percent recoveries 90-110%	Reanalyze and qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 90-110%
Surrogates	NA	NA	NA	NA	NA	NA
Cooler Temperature Blank	One per cooler	Cooler temperature 4ºC $\pm$ 2º	Contact client and qualify data.	Sample Receipt Personnel and Data Validator	Accuracy/bias	Cooler temperature 4ºC $\pm$ 2º

NA = Not Applicable
TBD = To Be Determined

QAPP Worksheet #28-7

QC Samples Table

Matrix	Soil					
Analytical Group	Hexavalent Chromium					
Concentration Level	Low					
Analytical Method/ SOP Reference	L-10					
Sampler's Name	TBD					
Field Sampling Organization	TRC					
Laboratory Name	Accutest Laboratories					
No. of Sample Locations	38					
Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Method Blank	Prior to samples and one per 20 samples	Hexavalent chromium < QL	Reclean, retest, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias-Contamination	Hexavalent chromium < QL
Equipment Blank	One per 20 samples	Hexavalent chromium < QL	Qualify data	Data Validator	Accuracy/bias-Contamination	Hexavalent chromium < QL
Instrument Blank	NA	NA	NA	NA	NA	NA
Laboratory Duplicate	One per 20 samples	RPD $\leq$ 20	Reanalyze and qualify data	Analyst and Data Validator	Precision	RPD $\leq$ 20
Matrix Spike	One per 20 samples	Percent recoveries 75-125%	Reanalyze and qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 75-125%
Matrix Spike Duplicates	NA	NA	NA	NA	NA	NA
LCS	One per batch	Percent recoveries 80-120%	Reanalyze and qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 80-120%
Surrogates	NA	NA	NA	NA	NA	NA
Cooler Temperature Blank	One per cooler	Cooler temperature 4ºC + 2º	Contact client and qualify data.	Sample Receipt Personnel and Data Validator	Accuracy/bias	Cooler temperature 4ºC + 2º

NA = Not Applicable
TBD = To Be Determined

QAPP Worksheet #28-8

QC Samples Table

Matrix	Surface Water					
Analytical Group	Hexavalent Chromium (total and dissolved)					
Concentration Level	Low					
Analytical Method/ SOP Reference	L-10					
Sampler's Name	TBD					
Field Sampling Organization	TRC					
Laboratory Name	Accutest Laboratories					
No. of Sample Locations	21					
Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Method Blank	Prior to samples and one per 20 samples	Hexavalent chromium < QL	Reclean, retest, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias-Contamination	Hexavalent chromium < QL
Storage Blank	NA	NA	NA	NA	NA	NA
Instrument Blank	NA	NA	NA	NA	NA	NA
Laboratory Duplicate	One per 20 samples	RPD $\leq$ 20	Reanalyze and qualify data	Analyst and Data Validator	Precision	RPD $\leq$ 20
Matrix Spike	One per 20 samples	Percent recoveries 75-125%	Reanalyze and qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 75-125%
Matrix Spike Duplicates	NA	NA	NA	NA	NA	NA
LCS	One per batch	Percent recoveries 80-120%	Reanalyze and qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 80-120%
Surrogates	NA	NA	NA	NA	NA	NA
Cooler Temperature Blank	One per cooler	Cooler temperature 4ºC $\pm$ 2º	Contact client and qualify data.	Sample Receipt Personnel and Data Validator	Accuracy/bias	Cooler temperature 4ºC $\pm$ 2º

NA = Not Applicable
TBD = To Be Determined

QAPP Worksheet #28-9

QC Samples Table

Matrix	Surface Water					
Analytical Group	VOCs					
Concentration Level	Low					
Analytical Method/ SOP Reference	L-1					
Sampler's Name	TBD					
Field Sampling Organization	TRC					
Laboratory Name	Accutest Laboratories					
No. of Sample Locations	19					
Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Method Blank	One every 12 hours before samples	No target compounds > QL (except methylene chloride and cyclohexane < 2.5x QL and acetone and 2-butanone < 5x QL)	Reclean, retest, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias-Contamination	No target compounds > QL (except methylene chloride and cyclohexane < 2.5x QL and acetone and 2-butanone < 5x QL)
Trip Blank	One per cooler	No target compounds > QL (except methylene chloride and cyclohexane < 2.5x QL and acetone and 2-butanone < 5x QL)	Qualify data	Data Validator	Accuracy/bias-Contamination	No target compounds > QL (except methylene chloride and cyclohexane < 2.5x QL and acetone and 2-butanone < 5x QL)
Storage Blank	NA	NA	NA	NA	NA	NA
Instrument Blank	As needed to assess carryover from high concentration samples	No target compounds $\geq$ QL	Reclean, retest, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias-Contamination	No target compounds $\geq$ QL
Laboratory Duplicate	NA	NA	NA	NA	NA	NA
Matrix Spike	One per 20 samples	Percent recoveries as per Worksheet #12-9	Reanalyze and qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries as per Worksheet #12-9
Matrix Spike Duplicates	One per 20 samples	Percent recoveries and RPDs as per Worksheet #12-9	Reanalyze and qualify data	Analyst and Data Validator	Accuracy/bias and Precision	Percent recoveries and RPDs as per Worksheet #12-9
Surrogates	4 per sample	Percent recoveries as per Worksheet #12-9	Reanalyze and qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries as per Worksheet #12-9
Internal Standards (ISs)	3 per sample	Area counts: -50% $\pm$100% of areas in associated continuing calibration standard Retention times: $\pm$ 30 seconds from retention times in associated continuing calibration standard	Reanalyze and qualify data	Analyst and Data Validator	Accuracy/bias and Precision	Area counts: -50% $\pm$100% of areas in associated continuing calibration standard Retention times: $\pm$ 30 seconds from retention times in associated continuing calibration standard

QAPP Worksheet #28-9

QC Samples Table

Matrix	Surface Water					
Analytical Group	VOCs					
Concentration Level	Low					
Analytical Method/ SOP Reference	L-1					
Sampler's Name	TBD					
Field Sampling Organization	TRC					
Laboratory Name	Accutest Laboratories					
No. of Sample Locations	19					
Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Laboratory Control Samples	One per day samples are analyzed	Percent recoveries 70-130%	Reanalyze and qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 70-130%
Cooler Temperature Blank	One per cooler	Cooler temperature 4ºC $\pm$ 2º	Contact client and qualify data.	Sample Receipt Personnel and Data Validator	Accuracy/bias	Cooler temperature 4ºC $\pm$ 2º

NA = Not Applicable
TBD = To Be Determined

QAPP Worksheet #28-10

QC Samples Table

Matrix	Surface Water					
Analytical Group	Metals (Total and Dissolved)					
Concentration Level	Low					
Analytical Method/ SOP Reference	L-5, L-8					
Sampler's Name	TBD					
Field Sampling Organization	TRC					
Laboratory Name	L-5: Accutest Laboratories L-8: Alpha Analytical Laboratory					
No. of Sample Locations	21					
Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Method Blank	One per preparation batch	No target compounds ≥ QL	Reclean, retest, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias-Contamination	No target compounds ≥ QL
Reagent Blank**	ICB: immediately after ICV CCB: every 10 samples immediately after CCV	No target compounds ≥ QL	Reclean, retest, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias-Contamination	No target compounds ≥ QL
Storage Blank	NA	NA	NA	NA	NA	NA
Instrument Blank	NA	NA	NA	NA	NA	NA
Laboratory Duplicate	One per 20 samples	RPD ≤ 20 if results ≥ 5x QL	Qualify data	Analyst and Data Validator	Precision	RPD ≤ 20 if results ≥ 5x QL
Matrix Spike	One per 20 samples	Percent recoveries 75-125%	Qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 75-125%
Matrix Spike Duplicates	NA	NA	NA	NA	NA	NA
LCS	One per batch	Percent recoveries 80-120%	Determine cause of problem, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 80-120%
Surrogates	NA	NA	NA	NA	NA	NA
Other: Serial Dilution	One per 20 samples	Within 10% of original determination	Qualify data	Analyst and Data Validator	Accuracy/bias	Within 10% of original determination
Other: QL Check Standard	Beginning and end of analytical sequence	Percent recoveries 70-130% (50-150% for cobalt, manganese, and zinc)	Recalibrate and reanalyze and/or qualify data	Analyst and Data Validator	Sensitivity and Accuracy/bias	Percent recoveries 70-130% (50-150% for cobalt, manganese, and zinc)
Other: Interference Check Sample	Beginning of run or every 8 hours	Percent recoveries 80-120%	Recalibrate and reanalyze and/or qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 80-120%

QAPP Worksheet #28-10

QC Samples Table

Matrix	Surface Water					
Analytical Group	Metals (Total and Dissolved)					
Concentration Level	Low					
Analytical Method/ SOP Reference	L-5, L-8					
Sampler's Name	TBD					
Field Sampling Organization	TRC					
Laboratory Name	L-5: Accutest Laboratories L-8: Alpha Analytical Laboratory					
No. of Sample Locations	21					
Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Internal Standards (ISs) (ICP/MS only)	Every sample	30-120% of IS in calibration standard	Dilute sample 5x, add IS and reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias	30-120% of IS in calibration standard
Cooler Temperature Blank	One per cooler	Cooler temperature 4ºC ± 2º	Contact client and qualify data.	Sample Receipt Personnel and Data Validator	Accuracy/bias	Cooler temperature 4ºC ± 2º

** Also referred to as initial and continuing calibration blanks.
NA = Not Applicable
TBD = To Be Determined

QAPP Worksheet #28-11

QC Samples Table

Matrix	Surface Water					
Analytical Group	Hardness					
Concentration Level	Low					
Analytical Method/ SOP Reference	L-12					
Sampler's Name	TBD					
Field Sampling Organization	TRC					
Laboratory Name	Accutest Laboratories					
No. of Sample Locations	21					
Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Method Blank	One per batch	Hardness < QL	Reclean, retest, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias-Contamination	Hardness < QL
Reagent Blank	NA	NA	NA	NA	NA	NA
Storage Blank	NA	NA	NA	NA	NA	NA
Instrument Blank	NA	NA	NA	NA	NA	NA
Laboratory Duplicate	One per 20 samples	RPD $\leq$ 20	Reanalyze and qualify data	Analyst and Data Validator	Precision	RPD $\leq$ 20
Matrix Spike	One per 20 samples	Percent recoveries 75-125%	Qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 75-125%
Matrix Spike Duplicates	NA	NA	NA	NA	NA	NA
LFB	NA	NA	NA	NA	NA	NA
Surrogates	NA	NA	NA	NA	NA	NA
Other:						
Cooler Temperature Blank	One per cooler	Cooler temperature 4ºC $\pm$ 2º	Contact client and qualify data.	Sample Receipt Personnel and Data Validator	Accuracy/bias	Cooler temperature 4ºC $\pm$ 2º

NA = Not Applicable
TBD = To Be Determined

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13.0 DATA MANAGEMENT TASKS

This section of the QAPP describes how project data and information will be documented, tracked and managed from their generation in the field to final use and storage in a manner that ensures data integrity and defensibility.

13.1 Project Documentation and Records

A complete file of project-related documents will be maintained in the TRC Philadelphia, PA office. Worksheet #29 identifies the documents and records that will be generated and maintained for all aspects of the project.

13.2 Field Analysis Data Package Deliverables

For the field analyses associated with this program, which consist of the water quality parameters and FID/PID screening of soil samples, data packages are not required. All field and QC sample results, calibrations, and calibration verifications will be recorded in the field logbook, on field screening forms, and/or on equipment calibration forms to ensure proper verification of the sample results.

13.3 Fixed Laboratory Data Package Deliverables

At a minimum, the data packages from the analytical chemistry laboratories will include the following:

1. Case narrative

    - summary of analytical methods used
    - correlation of field sample identifications and laboratory sample identifications
    - data qualifier definitions
    - deviations from established QA/QC procedures with corrective action

2. Sample results

    - project name
    - field sample identification
    - batch number
    - collection/extraction/analysis dates
    - detection limits
    - dilution factors
    - percent moisture

3. Sample documentation

   - original chains-of-custody
   - shipping documents
   - cooler receipt forms

4. Quality Assurance/Quality Control

   - spike recoveries (surrogates, MS/MSDs, LCSs)
   - measures of precision (laboratory duplicates, MS/MSDs)
   - control limits for accuracy and precision

5. Raw data, including chromatograms, quantitation reports, and spectra

Results for all soil and sediment samples must be reported on a dry weight basis. The laboratories will report values detected between the method detection limit and quantitation limit and qualify these results as estimated. The laboratory will report tentatively identified compounds (TICs) for the VOC and/or SVOC analyses of surface water, soil and sediment samples. Up to 30 TICs for VOCs and 30 TICs for SVOCs will be reported in each sample, as applicable.

In general, deliverables for TCL VOC, TCL SVOC, TCL pesticide, PCB Aroclors, metals, and hexavalent chromium analyses of soil, sediment, surface water, and tissue will be in a format consistent with Contract Laboratory Program Statement of Work requirements. Laboratory reports and data packages will be submitted to TRC for validation, as outlined in Worksheet #36.

13.4 Data Reporting Formats

Project field data will be recorded in dedicated logbooks and on standardized forms. Documentation of field activities is described in Section 11.1.

Analytical data recording and reporting are described below.

All information related to analysis will be documented in controlled laboratory logbooks, instrument printouts, or other approved forms. All entries that are not generated by an automated data system will be made neatly and legibly in permanent, waterproof ink. Information will not be erased or obliterated. Corrections will be made by drawing a single line through the error and entering the correct information adjacent to the cross-out. All changes will be initialed, dated, and, if appropriate, accompanied by a brief explanation. Unused pages or portions of pages will be crossed out to prevent future data entry. Laboratory records will be reviewed by the Laboratory Section Leaders on a regular basis, and by the Laboratory QA Manager periodically, to verify adherence to documentation requirements.

13.5 Electronic Deliverables

Electronic data and hard copies of the laboratory data report will be submitted by the laboratory upon completion. Section 13.3 discusses details of the hardcopy laboratory data report.

Electronic Data Deliverables (EDDs) will be provided by the laboratory in the specific format required by USEPA Region 2. Chemistry EDDs include the following types of files: chemistry sample information (SMP), test/results (TRS), test/results with QC (TRSQC) (if required), and batch information (BAT) (if required). The test/results file is a subset of the test/result with QC file and only one of the two files should be submitted. If the test/result data has accompanying quality control data then the test/result with QC file should be submitted and not the test/result (TRS) file. If there is no quality control data accompanying the data, the test/result file should be submitted and not the test/result with QC file. The data tables including data fields and formats submitted by the laboratory will be consistent with the USEPA Region 2 requirements.

Prior to submittal to USEPA Region 2, the Electronic Data Processor (EDP) will be used to check EDD files. The EDP performs a series of formatting checks on the files and then identifies any records that have errors along with a description of the errors. If any errors are identified, the data will be corrected before sending the files to EPA Region 2. The EDD will be submitted to USEPA Region 2 by e-mail. The EDD will be accompanied by a cover letter that specifies the information about the Site, the contact for any EDD technical questions regarding file names, any exceptions to the EDD format, and any requests for additional valid values, etc.

In addition to the USEPA Region 2 EDDs, EDDs will also be submitted in a GISKey format which will allow the data to be easily imported into TRC's SQL Server database. All data will be stored in this database and this database will be used to tabulate and analyze project data for various needs, including risk assessment and preparation of figures. The use of this database ensures data integrity and accuracy for all future data needs. In addition to this, electronic pdf copies of all laboratory data packages will be submitted by the laboratories on CD and will be stored by TRC with the project files, in the event further data evaluation is needed at anytime.

13.6 Data Handling and Management

13.6.1 Data Entry and Verification

All data entry performed by TRC or its contractors will be proofed 100% for accuracy. Verification will be carried out either by proofing a printout against the original data or by duplicate entry and comparison of the two data sets to detect discrepancies.

13.6.2 Data Transformation and Reduction

Data generated through field activities, or by the laboratory operation, will be reduced and/or validated prior to reporting. Measurements and sample collection information will be transcribed directly into the field logbook or onto standardized forms. If errors are made, results will be legibly crossed out, initialed and dated by the person recording the data, and corrected in

a space adjacent to the original (erroneous) entry. Daily reviews of the field records by the TRC Field Team Manager will ensure that:

- Logbooks and standardized forms have been filled out completely and that the information recorded accurately reflects the activities that were performed.

- Records are legible and in accordance with good record keeping procedures: i.e., entries are signed and dated, data are not obliterated, changes are initialed, dated, and explained.

- Sample collection, handling, preservation, and storage procedures were conducted in accordance with the protocols described in the QAPP, and that any deviations were documented and approved by the appropriate personnel.

- Instruments were calibrated and operated in accordance with the procedures specified in the QAPP.

Data entered from the field records into the database must be reviewed and approved by the TRC Field Team Manager prior to release.

Laboratory data reduction procedures will be performed according to procedures in the laboratory's QA Manuals. These procedures are also summarized in Section 16.4.

13.6.3 Data Transfer and Transmittal

Hard copy data packages and EDDs from the laboratories will be transmitted to TRC upon completion of analysis. Copies of these transmittals will be forwarded to the TRC Project Manager for storage in the project files. Hard copy reports and EDDs will be logged in to TRC's validation tracking log. As the package proceeds through data validation, review, and data management, the status of the package will be recorded in the log. Completion of validation and final disposition of the package will also be documented.

13.6.4 Data Analysis and Reporting

Data reports will present summaries of validated data collected during the field investigation. Previously existing Excel spreadsheets will be updated with the results of this investigation. A quality assurance review of each sample result will be performed to ensure that the data in the Excel spreadsheet match the hard copy provided by the laboratory. After the data are validated, appropriate modifications to the Excel spreadsheet will be made to reflect the changes resulting from data validation (if any). A second quality assurance review will be performed after the validated data are in the Excel spreadsheet.

13.7 Data Tracking and Control

Management of field data is described in Section 11.2. Laboratory data will be maintained as described in the laboratory's QA Manuals. TRC is the custodian of the project files and will maintain the contents of the files, including relevant records, reports, logs, field notebooks,

pictures, subcontractor reports, and data reviews in a secured, limited access area. TRC's policy is to retain all project files for a period of six years beyond project completion. All files will be stored with the TRC-Philadelphia, PA office.

QAPP Worksheet #29

Project Documents and Records Table

Sample Collection Documents and Records	On-site Analysis Documents and Records	Off-site Analysis Documents and Records	Data Assessment Documents and Records	Other
Field Notes/Logbooks	Sample Receipt, Custody and Tracking Records	Sample Receipt, Custody and Tracking Records	Field Sampling Audit Checklists (if applicable)	
Chain-of-Custody Records	Equipment Calibration Logs	Standard Traceability Logs	Fixed Lab Audit Checklist (if applicable)	
Air Bills	Equipment Maintenance, Testing and Inspection Logs	Equipment Calibration Logs	Data Validation Reports	
Custody Seals	Sample Disposal Records	Sample Preparation Logs	Corrective Action Forms	
Telephone Logs	Field Activity Forms	Run Logs	Telephone Logs	
Corrective Action Forms	Telephone Logs	Equipment Maintenance, Testing and Inspection Logs	Data Usability Assessment Report	
Field Forms	Corrective Action Forms	Corrective Action Forms	Site Characterization Summary Report	
Photographs	Reported Field Sample Results	QC Sample Results Reports		
Boring Logs	Decontamination Records	Instrument Printout (raw data) for field samples, standards, QC checks and QC samples		
	Sample Disposal Records	Sample Disposal Records		
		Telephone Logs		
		Reported Field Sample Results		
		Extraction/Clean-up records		
		Raw Data (stored on CD)		
		Electronic Data Deliverables		
		Project Database		

QAPP Worksheet #30

Analytical Services Table

Matrix	Analytical Group	Concentration Level	Analytical Method/SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address: Contact Person and Telephone Number)	Backup Laboratory/ Organization (Name and Address: Contact Person and Telephone Number)
Soil	VOCs, Metals, pH, Hexavalent Chromium, ORP	Low	L-1, L-5, L-9, L-10, L-11	14 days[1, 2]	Accutest Laboratories 2235 Route 130 Dayton, NJ 08810 Contact: Marie Meidhof (732) 329-0200	None
Surface Water	VOCs, Metals, Hexavalent Chromium, Hardness	Low	L-1, L-5, L-10, L-12	14 days	Accutest Laboratories 2235 Route 130 Dayton, NJ 08810 Contact: Marie Meidhof (732) 329-0200	None
Sediment	SVOCs, Pesticides, PCB Aroclors, Metals, TOC, Grain Size, pH	Low	L-2, L-3, L-4, L-5, L-6, L-7, L-9, L-10, L-11	14 days	Accutest Laboratories 2235 Route 130 Dayton, NJ 08810 Contact: Marie Meidhof (732) 329-0200	None
Surface Water	Select Metals (Aluminum, Cadmium, Cobalt, Copper, Selenium, Vanadium)	Low	L-8	14 days	Alpha Analytical Laboratory 320 Forbes Blvd., Mansfield, MA 02048 Contact: Mary Davis (508) 898-9220	None
Stream Bank Soil	SVOCs, Pesticides, PCB Aroclors, Metals, pH, Hexavalent Chromium, ORP	Low	L-2, L-3, L-4, L-5, L-9, L-10, L-11	14 days	Accutest Laboratories 2235 Route 130 Dayton, NJ 08810 Contact: Marie Meidhof (732) 329-0200	None
Tissue	Metals	Low	L-8, L-13	14 days	Alpha Analytical Laboratory 320 Forbes Blvd., Mansfield, MA 02048 Contact: Mary Davis (508) 898-9220	None

[1]Surface soil samples collected along the property lines (SB-95 thru SB-97, SB-104 and SB-105) will be analyzed on a 3-5 day turnaround time for all parameters.
[2]Subsurface soil samples collected from the Former Production Area (Manpro-Vibra Degreasing Unit) and the Former Lagoons Area will be analyzed on a 3-5 day turnaround time for VOCs.

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14.0 ASSESSMENTS AND RESPONSE ACTIONS

14.1 Planned Assessments

Worksheet #31 summarizes potential assessments during this investigation.

14.1.1 Internal Assessments

Technical system audits (TSAs) of both field and laboratory activities are conducted to verify that sampling and analysis are performed in accordance with the procedures established in the QAPP.

Field Sampling TSAs

A system audit of field activities, including sampling and field measurements, may be conducted and documented by the TRC Project QA Manager (or her designee) at the start of sampling. The purpose of this audit is to verify that established procedures are being followed as planned and documented and to allow for timely corrective action, reducing the impact of the nonconformance. The audit will ensure that personnel have read the QAPP and have signed Worksheet #4. The audit will cover field sampling records, field measurement results, field instrument operation and calibration records, sample collection, preservation, handling, and packaging procedures, adherence to QA procedures, personnel training, sampling procedures, decontamination procedures, review of sampling design versus the Work Plans, corrective action procedures, and chain-of-custody, etc. Follow-up surveillance will be conducted by the TRC Field Team Manager to verify that QA procedures are maintained throughout the investigation. An example of a field TSA checklist is included as Figure 14-1.

Upon completion of the audit, the TRC Project QA Manager will prepare a written audit report, which summarizes the audit findings, identifies deficiencies and recommends corrective actions. In addition, a verbal debriefing will also be given to the TRC Field Team Manager and TRC Project Manager at the time of the audit. The written report will be submitted to the TRC Project Manager, who will be responsible for ensuring that corrective measures are implemented.

Fixed Laboratory TSAs

Internal laboratory audits may be conducted by the TRC Project QA Manager (or her designee). The fixed laboratory TSA includes a review of the following areas:

- QA organization and procedures (including the Laboratory QA Plan),
- Personnel training and qualifications,
- Facility security
- Sample log-in procedures,
- Sample storage facilities,
- Analyst technique
- Adherence to EPA methods and the QAPP,
- Compliance with QA/QC objectives,

- Equipment, instrumentation and supplies kept on reserve,
- Instrument calibration and maintenance,
- Data recording, reduction, review, and reporting, and
- Cleanliness and housekeeping.

An example of a fixed laboratory TSA checklist is included as Figure 14-2. Preliminary results of the TSA will be discussed with the Laboratory Manager, Laboratory Project Manager, and Laboratory QA Manager during a verbal debriefing held at the facility. Assessment findings will be documented and reported as described in Section 14.2.

Data Validation TSA

An audit of the complete Data Validation Report will be conducted prior to submitting the report to EPA. This audit will include a review of the associated analytical data package deliverables for completeness and a review of the Data Validation Report to ensure that required components are present. This audit will also ensure that the most recent version of the EPA Region II data validation guidelines were followed and that measurement performance criteria were met.

14.1.2 External Assessments

External assessments will be the responsibility of the EPA Region 2 or NJDEP, and performed as needed.

14.2 Assessment Findings and Corrective Action Responses

The results of the field sampling and fixed laboratory TSAs will be documented in written reports; in addition, verbal debriefings will also be held at the conclusion of audits. The reports will be prepared by the auditor and will describe the scope of the TSA, summarize audit findings, and recommend corrective action. The report will be distributed to the appropriate personnel for response: the TRC Field Team Manager will be responsible for responding to the field sampling TSA report, and the Laboratory QA Manager will be responsible for addressing the fixed laboratory TSA report. Significant issues that are discovered during the TSA and which could potentially affect data quality or usability will be brought to the immediate attention of the TRC Project Manager.

The results of the Data Validation TSA will be noted on the Data Validation Report and/or documented in a written report. Data Validation Reports will be corrected based on the results of this audit prior to submittal to EPA.

Figure 14-1 Example of Field Sampling TSA Checklist

Project: **Site Location:** **Auditor:**	
1. Was project-specific training held?	
2. Are copies of project plan on site and available to personnel?	
3. Are samples being collected in accordance with the project plan?	
4. Do the numbers and locations of samples conform to the project plan?	
5. Are sample locations flagged, staked, or otherwise marked?	
6. Are samples labeled in accordance with the project plan?	
7. Is equipment decontamination in accordance with the project plan?	
8. Is field instrumentation being operated and calibrated in accordance with the project plan?	
9. Are samples being preserved and containerized in accordance with the project plan?	
10. Are QC samples in accordance with the types, collection procedures, and frequencies specified in the project plan?	
11. Are chain-of-custody procedures and documents in conformance with the project plan?	
12. Are field records complete, accurate, up-to-date, and in conformance to good record keeping procedures?	
13. Are modifications to the project plan being communicated, approved, and documented appropriately?	
Additional Comments:	
Auditor:	**Date:**

Figure 14-2 Example of Fixed Laboratory TSA Checklist

Project: **Facility Location:** **Auditor:**	
Is there a written QA Program Plan/Manual?	
Is there a designated QA Officer?	
Are facilities and equipment adequate to perform the analyses of interest?	
Review procedures and engineering controls for minimizing cross contamination.	
Review most recent interlaboratory PE sample results and recent Agency audits.	
Review SOP system. Review techniques for conformance to approved SOPs.	
Are personnel qualified and trained? Is there a formal training program and are records of training and proficiency maintained?	
Is there a designated sample custodian? Is there a sample inspection checklist? Are sample log-in procedures defined in an SOP?	
Is the laboratory area secure?	
Review internal chain-of-custody procedures.	
Are instruments operated and calibrated in accordance with the EPA methods or laboratory SOPs? Are records of calibration maintained?	
Is equipment maintained according to written protocols? Are routine and non-routine maintenance procedures documented?	
Are samples being analyzed in conformance to the EPA methods or laboratory SOPs?	
Are QC samples and checks being performed at the frequencies stated in the EPA methods or laboratory SOPs?	
Are records complete, accurate, up-to-date, and in conformance to good record keeping procedures?	
How are project-specific requirements communicated to the bench level?	
Review data reduction, review, and reporting processes.	
Review data archival process (paper and electronic).	
Review audit and corrective action program.	
Additional Comments:	
Auditor:	**Date:**

The response to the TSA reports will include a description of the corrective action(s) to be implemented, the identities of the personnel responsible for implementing the corrective action, and the schedule for implementation/completion. Responses must be completed within one week of issuing the TSA report. The response will be reviewed by the TRC Project QA Manager and, if issues have been addressed appropriately and in a timely manner, no further action will be required. In the event that the corrective action(s) are inadequate or inappropriate, follow-up activities, including additional audits, or discussions with the TRC Project Manager, will be conducted by the TRC Project QA Manager. The complete TSA report, including resolution of any deficiencies, will be included in the QA reports to management, as described in Section 15.0.

14.3 Additional QAPP Non-Conformances

14.3.1 Field Non-Conformances

Corrective action in the field may be needed when the sample network is changed (i.e., more/less samples, sampling locations other than those specified in the QAPP), or when sampling procedures and/or field analytical procedures require modification, etc. due to unexpected conditions. The field team may identify the need for corrective action. The TRC Field Team Manager will approve the corrective action and notify the TRC Project Manager. The TRC Project Manager, in consultation with the EPA Remedial Project Manager, if necessary, will approve the corrective measure. The TRC Field Team Manager will ensure that the corrective measure is implemented by the field team. Corrective actions will be implemented and documented in the field logbook. Documentation will include:

- A description of the circumstances that initiated the corrective action,
- The action taken in response,
- The final resolution, and
- Any necessary approvals.

No staff member will initiate corrective action without prior communication of findings through the proper channels. If necessary, a problem resolution audit will be conducted.

14.3.2 Laboratory Non-Conformances

Corrective action in the laboratory may occur prior to, during, and after initial analyses. A number of conditions such as broken sample containers, omissions or discrepancies with chain-of-custody documentation, low/high pH readings, and potentially high concentration samples may be identified during sample log-in or just prior to analysis. Following consultation with laboratory analysts and Laboratory Section Leaders, it may be necessary for the Laboratory QA Manager to approve the implementation of corrective action. The EPA methods, and laboratory SOPs specify some conditions during or after analysis that may automatically trigger corrective action or optional procedures. These conditions may include dilution of samples, additional sample extract cleanup, automatic reinjection/reanalysis when certain QC criteria are not met, loss of sample through breakage or spillage, etc.

The analyst may identify the need for corrective action. The Laboratory Section Leader, in consultation with the staff, will approve the required corrective action to be implemented by the laboratory staff. The Laboratory QA Manager will ensure implementation and documentation of the corrective action. If the nonconformance causes project objectives not to be achieved, the TRC Project QA Manager will be notified. The TRC Project QA Manager will contact levels of project management for concurrence with the proposed corrective action.

These corrective actions are performed prior to release of the data from the laboratory. The corrective action will be documented in both the laboratory's corrective action files, and the narrative data report sent from the laboratory to TRC. If the corrective action does not rectify the situation, the laboratory will contact the TRC Project QA Manager, who will determine the action to be taken and inform the appropriate personnel. If necessary, a problem resolution audit will be conducted.

14.4 Data Validation and Data Assessment Non-Conformances

The need for corrective action may be identified during either data validation or data assessment. Potential types of corrective action may include resampling by the field team or reinjection/reanalysis of samples by the laboratory. These actions are dependent upon the ability to mobilize the field team and whether the data to be collected are necessary to meet the required QA objectives. If the data validator or data assessor identifies a corrective action situation, the TRC Project Manager will be responsible for informing the appropriate personnel. Corrective actions of this type will be documented by the TRC Project Manager and maintained in the project files.

QAPP Worksheet #31

Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings(Title and Organizational Affiliation)	Person (s) Responsible for Identifying and Implementing Corrective Actions (CA) (Title and Organizational Affiliation)	Person (s) Responsible for Monitoring Effectiveness of CA (Title and Organizational Affiliation)
Field Sampling Technical System Audit (if required)	1/ at startup of sampling events	Internal	TRC Environmental	Elizabeth Denly/Project QA Manager, TRC Environmental	Field staff, TRC Environmental	TBD/Field Team Manager and Jorge Gomez/Project Manager, TRC Environmental	Elizabeth Denly/ Project QA Manager, TRC Environmental
Fixed Laboratory Technical Systems Audit (if required)	1/ at startup of sampling	External	TRC Environmental	Elizabeth Denly/ Project QA Manager, TRC Environmental	Laboratory QA Manager	Laboratory QA Manager	Laboratory QA Manager
Data Validation Technical Systems Audit	1 per data package	Internal	TRC Environmental	Elizabeth Denly/ Project QA Manager, TRC Environmental	Data Validator, TRC Environmental	Data Validator, TRC Environmental	Elizabeth Denly/ Project QA Manager, TRC Environmental
Data Package Technical Systems Audit	1 per data package	External	TRC Environmental	Data Validator, TRC Environmental	Laboratory QA Manager	Laboratory QA Manager	Data Validator, TRC Environmental

QAPP Worksheet #32

Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Acton Response (Name, Title, Org.)[1]	Timeframe for Response
Field Sampling TSA	Written Audit Report	TBD/Field Team Manager and Jorge Gomez/Project Manager, TRC Environmental	48 hours after audit	Letter	Elizabeth Denly/ Project QA Manager, TRC Environmental	48 hours after notification
Fixed Laboratory TSA	Written Audit Report	Laboratory QA Manager	3 days after audit	Letter	Elizabeth Denly/ Project QA Manager, TRC Environmental	1 week after notification
Data Validation TSA	Written Audit Report	Data Validator, TRC Environmental	2 weeks after data validation report received	Memorandum	Elizabeth Denly/ Project QA Manager, TRC Environmental	1 week after notification
Data Package TSA	Electronic Mail Notification	Laboratory Project Manager	2 weeks after data package received	Electronic Mail	Data Validator, TRC Environmental	3 days after notification

[1] As per Section 4.2 of the QAPP, The TRC Project Manager will notify the TRC Project Coordinator of any issues which may potentially affect the achievement of project objectives. The TRC Project Coordinator will in turn notify the EPA Remedial Project Manager of these issues. Therefore, regulatory agencies may not be notified of all corrective actions, only those that may affect the achievement of project objectives. If Field Sampling TSAs or Fixed Laboratory TSAs are performed, these will be performed at the onset of the program to ensure any potential corrective actions are in place as soon as possible.

15.0 QA MANAGEMENT REPORTS

QA reports will be submitted to the TRC Project Manager to ensure that any problems identified during the sampling and analysis programs are investigated and the proper corrective measures taken in response. Worksheet #33 summarizes QA management reports which may be submitted during this investigation. The QA reports may include:

- Results of field and laboratory audits,
- Problems noted during data validation and assessment,
- Significant QA/QC problems, recommended corrective actions, and the outcome of corrective actions,
- Data usability assessments, and
- The final project report.

QA reports will be prepared and submitted on an as-needed basis.

QAPP Worksheet #33

QA Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipients (Title and Organizational Affiliation)
Verbal Status Report	Daily	At the end of every day of field activities	TBD, Field Team Manager, TRC Environmental	Jorge Gomez, Project Manager, TRC Environmental
Verbal or Written Status Report	As necessary	As necessary	Jorge Gomez, Project Manager, TRC Environmental	Patrick Hansen, Project Coordinator, TRC Environmental
Corrective Action Report	As necessary	As necessary	Elizabeth Denly, Project QA Manager, TRC Environmental	Jorge Gomez, Project Manager, TRC Environmental
Field Sampling Technical Systems Audit Report (if applicable)	One/ at startup of sampling	Within 2-3 days of audit	Elizabeth Denly, Project QA Manager, TRC Environmental	Jorge Gomez, Project Manager, TRC Environmental
Off-site Laboratory Technical Systems Audit Report (if applicable)	One/prior to sampling startup	Within 2-3 days of audit	Elizabeth Denly, Project QA Manager, TRC Environmental	Laboratory QA Manager
Data Usability Assessment Report	One/ after data generated and validated	TBD	Elizabeth Denly, Project QA Manager, TRC Environmental	Jorge Gomez, Project Manager, TRC Environmental
Final Project Report	One/ after sampling and risk assessment completed	TBD	Jorge Gomez, Project Manager and Patrick Hansen, Project Coordinator, TRC Environmental	Sherrel Henry, Remedial Project Manager, EPA Donna Gaffigan, Case Manager, NJDEP

TBD: To Be Determined

16.0 DATA REVIEW STEPS

16.1 Step I: Verification and Step II: Validation

Data generated through field activities, or by the laboratory operation, will be reduced and validated prior to reporting. No data will be disseminated by TRC or its subcontractors until it has been subjected to the procedures summarized below.

Worksheets #34, 35, and 36 summarize the data verification processes for data generated during this investigation.

16.2 Field Sampling Data

Field sampling data will be verified daily by each person performing the tasks. These data will be verified for completeness and correctness. Field sampling data will also be independently reviewed daily by the TRC Field Team Manager to ensure that records are complete, accurate, and legible and verify that the sampling procedures are in accordance with the protocols specified in the QAPP. Personnel performing the verification tasks will sign the field notes after verification. Verification will include field logbook notes, field sampling forms, and COCs. Details of the review of field records are provided below.

Sample collection information will be transcribed directly into the field logbook or onto standardized forms. If errors are made, results will be legibly crossed out, initialed and dated by the person recording the data, and corrected in a space adjacent to the original (erroneous) entry. Each member of the field sampling team will be responsible for an internal verification of the transcribed information. Daily external verification of the field records by the TRC Field Team Manager will ensure that:

- Logbooks and standardized forms have been filled out completely and that the information recorded accurately reflects the activities that were performed.
- Records are legible and in accordance with good record keeping procedures: i.e., entries are signed and dated, data are not obliterated, changes are initialed, dated, and explained.
- Sample collection, handling, preservation, and storage procedures were conducted in accordance with the protocols described in the QAPP, and that any deviations were documented and approved by the appropriate personnel.

External verification of the chains-of-custody will be performed by the TRC Project QA Manager to ensure that appropriate samples were collected and submitted to the laboratory for the correct analyses.

16.3 Field Analysis Data

Each member of the sampling team performing field analysis tasks will verify their own data at the conclusion of each day for completeness and correctness. Field analysis data will also be independently verified by the TRC Field Team Manager or TRC Project QA Manager to ensure that records are complete, accurate, and legible and verify that the calibration procedures are in

accordance with the protocols specified in the QAPP. Personnel performing the verification tasks will sign the field notes after verification. Verification will include a review of field logbook notes and equipment calibration forms. Details of the review of field analysis records are provided below.

Field analysis information will be transcribed directly into the field logbook or onto standardized forms. If errors are made, results will be legibly crossed out, initialed and dated by the person recording the data, and corrected in a space adjacent to the original (erroneous) entry. Each member of the field sampling team will be responsible for an internal verification of the transcribed information. Daily external verification of the field analysis records by the TRC Project QA Manager will ensure that:

- Logbooks and standardized forms have been filled out completely and that the information recorded accurately reflects the activities that were performed.
- Records are legible and in accordance with good record keeping procedures, i.e., entries are signed and dated, data are not obliterated, changes are initialed, dated, and explained.
- Calibration procedures were conducted in accordance with the protocols described in the QAPP, and that any deviations were documented and approved by the appropriate personnel.

16.4 Fixed Laboratory Data

Internal Reviews

Prior to the release of any data from the laboratory, the data will be verified and approved by laboratory personnel. This review will consist of a tiered review by the person performing the work, a qualified peer, and by supervisory personnel. Details of the review are provided below.

Prior to being released as final, laboratory data will proceed through a tiered review process. Data verification starts with the analyst or technician who performs a 100 percent review of the data to ensure the work was done correctly the first time. It is the responsibility of the analyst or technician to ensure that the verification of data in his or her area is complete. The data reduction and initial verification process must ensure that:

- Sample preparation and analysis information is correct and complete,
- Results are correct and complete,
- The appropriate EPA methods or laboratory SOPs have been followed and are identified in the project records,
- Proper documentation procedures have been followed,
- Nonconformances have been documented, and
- Project-specific requirements have been met.

Following the completion of the initial verification by the analyst or technician, a systematic check of the data will be performed by an experienced peer, Laboratory Section Leader, or designee. This check will be performed to ensure that initial review has been completed correctly and thoroughly. Included in this review will be an assessment of the acceptability of the data with respect to:

- Adherence of the procedure used to EPA methods and laboratory SOPs, and any project-specific methods and specific instructions,
- Correct interpretation of data (e.g., mass spectra, chromatographic interferences, etc.),
- Correctness of numerical input when computer programs are used (checked randomly) and numerical correctness of calculations and formulas (checked randomly),
- Acceptability of QC data,
- Documentation that instruments were operating according to method specifications (calibrations, performance checks, etc.),
- Documentation of dilution factors, standard concentrations, etc.,
- Sample holding time assessment,
- Nonconforming events have been addressed by corrective action as defined on a nonconformance memo.

A third-level review will be performed by the Laboratory Project Manager before results are submitted to the client. This review serves to verify the completeness of the data report and to ensure that project requirements are met for the analyses performed. The items to be reviewed will include:

- Results are present for samples in the analytical batch or reporting group,
- Parameters or target compounds requested are reported,
- The correct units and correct number of significant figures are utilized,
- Nonconformances, including holding time violations, and data evaluation statements that impact the data quality are accompanied by clearly expressed comments from the laboratory,
- The final report is legible, contains the supporting documentation required by the project, and is in either the standard format or in the client-required format.

A narrative to accompany the final report will be finalized by the Laboratory Project Manager. This narrative will include relevant comments, including data anomalies and nonconformances.

Independent Review

An independent review of fixed laboratory data will be performed in order to determine the quality of the analytical data. Project-specific procedures will be used to validate analytical laboratory data. The basis for the validation will be from the following documents:

- Validating Volatile Organic Compounds by SW-846 Method 8260B, HW-24, Revision 2, August 2008, Region 2.
- Validating Semivolatile Organic Compounds by SW-846 Method 8270, HW-22, Revision 4, August 2008, Region 2.
- Data Validation SOP of Organochlorine Pesticides by Gas Chromatography SW-846 Method 8081B, HW-44, Revision 1, October 2006, Region 2.
- Data Validation SOP of Organic Analysis of PCBs by Gas Chromatography SW-846 Method 8082A, HW-45, Revision 1, October 2006, Region 2.
- USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA 540-R-04-004, October 2004.

- Evaluation of Metals Data for the CLP Program, HW-2, Revision 13, September 2006, Region 2.

These documents will be modified to include method-specific criteria (i.e., measurement performance criteria detailed in this QAPP). Worksheets #12, 15, 19, 28, the EPA methods and the laboratory SOPs summarize the QC criteria and holding time requirements for analyses conducted under this program. These criteria will be used to evaluate and qualify the data during validation and will be substituted for the default validation criteria listed in the guidelines, when necessary.

Validation will be performed by TRC and will follow one or more of the validation guidelines listed above. Up to twenty-five percent of the soil, sediment, surface water, and/or tissue data for VOCs, SVOCs, pesticides, PCB Aroclor, metals, and hexavalent chromium analyses will be subjected to full validation, as per Region II data validation guidelines. A completeness check, an overall evaluation of data and potential usability issues, technical holding times and QC sample results (blanks, surrogate spikes, MS/MSDs, matrix duplicates, and LCSs) will be included in the review.

Validation procedures used by the TRC Project QA Manager on field parameters will include a review of the daily calibration checks performed on the instrumentation in the field in comparison to the QAPP requirements and a review of the results to ensure that results appear reasonable, as reported. Validation will not be performed for the TOC, pH and ORP analyses of soil and/or sediment samples. It should be noted that although only a percentage of the data will be subjected to validation that all data will undergo a usability assessment as outlined in Section 17.

Upon completion of the validation, a report will be prepared. These reports will be consistent with the EPA Region II validation guidelines. Qualifiers applied to the data during validation will be entered into the electronic data deliverables in the database. Validated data will be used to generate tables and figures.

QAPP Worksheet #34

Verification (Step I) Process Table

Verification Input	Description	Internal / External	Responsible for Verification (Name, Organization)
Chains-of-Custody and Shipping Forms	Chain-of-Custody forms and shipping documentation will be reviewed internally upon their completion and verified against the packed sample coolers for which they represent. When everything checks out, a copy of the chain-of-custody will be retained in the site file, and the original and remaining copies will be taped inside the cooler for shipment. See Section 11.0 for further details.	Internal	Field Team Manager, TRC Environmental Corporation
Field Notes	Field notes will be reviewed on a daily basis to ensure notes are accurate, all necessary calibration information has been documented, and notes are complete. Field notes will be placed in the site file and attached to the final report.	Internal	Field Team Manager, TRC Environmental Corporation
Audit Reports	Upon report completion, a copy of all audit reports will be placed in the project file. If corrective actions are required, a copy of the documented corrective action taken will be attached to the appropriate audit report in the site file. At the beginning of each week, and at the completion of the site work, project file audit reports will be reviewed internally to ensure that all appropriate corrective actions have been taken and that corrective action reports are attached. If corrective actions have not been taken, the Field Team Manager will be notified to ensure action is taken.	Internal	Jorge Gomez, TRC Environmental Corporation
QAPP	All aspects of the project (field sampling, laboratory analyses, data validation) will be continuously verified versus the EPA-approved QAPP.	Internal	Elizabeth Denly, TRC Environmental Corporation
Laboratory Data Packages	All laboratory data packages will be verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal.	Internal	Marie Meidhof, Accutest Laboratories Mary Davis, Alpha Analytical Laboratory
Laboratory Data Packages	All received data packages will be verified according to the data validation procedures specified in Worksheet #36.	Internal	Elizabeth Denly, TRC Environmental Corporation
Data Validation Reports	All data validation reports will be technically reviewed for accuracy and completeness.	Internal	Elizabeth Denly, TRC Environmental Corporation
Electronic Data Deliverables	EDDs will be used to import data into TRC's database. The imported data will be verified with the validated data for accuracy.	Internal	Elizabeth Denly, TRC Environmental Corporation

QAPP Worksheet #35

Validation (Steps IIa and IIb) Process Table

Step IIa/IIb	Validation Input	Description	Responsibility for Data Validations (Name, Organizational affiliation)
IIb	On-site Analytical Work	All on-site analytical work will be reviewed against QAPP requirements for completeness and accuracy based on the field calibration records.	Field Team Manager, TRC Environmental Corporation
IIa	Sampling Procedures	Ensure that all sampling procedures in Work Plans and QAPP were followed.	Field Team Manager, TRC Environmental Corporation
IIa	SOPs	Ensure that all analytical methods and SOPs were followed.	Elizabeth Denly, TRC Environmental Corporation
IIa	Documentation of Method QC Results	Establish that all method-required QC samples were run and met required limits.	Elizabeth Denly, TRC Environmental Corporation
IIb	Documentation of QAPP QC Sample Results	Establish that all QAPP-required QC samples were run and met required limits.	Elizabeth Denly, TRC Environmental Corporation
IIb	Project Quantitation Limits	Ensure that all sample results met the project quantitation limits specified in the QAPP.	Elizabeth Denly, TRC Environmental Corporation
IIa	Raw Data	Spot checks of raw data will be performed to confirm laboratory calculations.	Elizabeth Denly, TRC Environmental Corporation

QAPP Worksheet #36

Validation (Steps IIa and IIb) Summary Table*

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (Name and Organizational Affiliation)
IIa	Soil	TCL VOCs	High	(1)	Elizabeth Denly, TRC
IIb	Soil	TCL VOCs	High	Worksheets # 12-1, 15-6, 24, 25, 28-1	Elizabeth Denly, TRC
IIa	Soil	TAL Metals/Vanadium/Chromium	Low	(5), (6)	Elizabeth Denly, TRC
IIb	Soil	TAL Metals/Vanadium/Chromium	Low	Worksheets # 12-5, 15-10, 24, 25, 28-2	Elizabeth Denly, TRC
IIa	Soil	pH and ORP	NA	NA	NA
IIb	Soil	pH and ORP	NA	NA	NA
IIa	Soil	Hexavalent chromium	Low	(6)	Elizabeth Denly, TRC
IIb	Soil	Hexavalent chromium	Low	12-8, 15-11, 24, 25, 28-7	Elizabeth Denly, TRC
IIa	Sediment	TCL SVOCs	Low	(2)	Elizabeth Denly, TRC
IIb	Sediment	TCL SVOCs	Low	Worksheets # 12-2, 15-1, 24, 25, 28-3	Elizabeth Denly, TRC
IIa	Sediment	TCL Pesticides	Low	(3)	Elizabeth Denly, TRC
IIb	Sediment	TCL Pesticides	Low	Worksheets # 12-4, 15-2, 24, 25, 28-4	Elizabeth Denly, TRC
IIa	Sediment	PCB Aroclors	Low	(4)	Elizabeth Denly, TRC
IIb	Sediment	PCB Aroclors	Low	Worksheets # 12-3, 15-3, 24, 25, 28-5	Elizabeth Denly, TRC
IIa	Sediment	Total Organic Carbon	NA	NA	NA
IIb	Sediment	Total Organic Carbon	NA	NA	NA
IIa	Sediment	TAL Metals	Low	(5), (6)	Elizabeth Denly, TRC
IIb	Sediment	TAL Metals	Low	Worksheets # 12-5, 15-4, 24, 25, 28-2	Elizabeth Denly, TRC
IIa	Sediment	Grain Size	NA	NA	NA
IIb	Sediment	Grain Size	NA	NA	NA

QAPP Worksheet #36

Validation (Steps IIa and IIb) Summary Table*

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (Name and Organizational Affiliation)
IIa	Sediment	pH	NA	NA	NA
IIb	Sediment	pH	NA	NA	NA
IIa	Stream Bank Soil	TCL SVOCs	Low	(2)	Elizabeth Denly, TRC
IIb	Stream Bank Soil	TCL SVOCs	Low	Worksheets # 12-2, 15-7, 24, 25, 28-3	Elizabeth Denly, TRC
IIa	Stream Bank Soil	TCL Pesticides	Low	(3)	Elizabeth Denly, TRC
IIb	Stream Bank Soil	TCL Pesticides	Low	Worksheets # 12-4, 15-8, 24, 25, 28-4	Elizabeth Denly, TRC
IIa	Stream Bank Soil	PCB Aroclors	Low	(4)	Elizabeth Denly, TRC
IIb	Stream Bank Soil	PCB Aroclors	Low	Worksheets # 12-3, 15-9, 24, 25, 28-5	Elizabeth Denly, TRC
IIa	Stream Bank Soil	TAL Metals	Low	(5), (6)	Elizabeth Denly, TRC
IIb	Stream Bank Soil	TAL Metals	Low	Worksheets # 12-5, 15-10, 24, 25, 28-2	Elizabeth Denly, TRC
IIa	Stream Bank Soil	pH and ORP	NA	NA	NA
IIb	Stream Bank Soil	pH and ORP	NA	NA	NA
IIa	Stream Bank Soil	Hexavalent Chromium	Low	(6)	Elizabeth Denly, TRC
IIb	Stream Bank Soil	Hexavalent Chromium	Low	Worksheets # 12-8, 15-11, 24, 25, 28-7	Elizabeth Denly, TRC
IIa	Surface Water	TCL VOCs	Low	(1)	Elizabeth Denly, TRC
IIb	Surface Water	TCL VOCs	Low	Worksheets # 12-9, 15-12, 24, 25, 28-9	Elizabeth Denly, TRC
IIa	Surface Water	TAL Metals/Hardness	Low	(5), (6)	Elizabeth Denly, TRC
IIb	Surface Water	TAL Metals/Hardness	Low	Worksheets # 12-10, 12-11, 15-13, 24, 25, 28-10, 28-11	Elizabeth Denly, TRC
IIa	Surface Water	Al, Cd, Co, Cu, Se, V	Low	(5), (6)	Elizabeth Denly, TRC
IIb	Surface Water	Al, Cd, Co, Cu, Se, V	Low	Worksheets # 12-10, 15-13a, 24, 25, 28-10	Elizabeth Denly, TRC

QAPP Worksheet #36

Validation (Steps IIa and IIb) Summary Table*

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (Name and Organizational Affiliation)
IIa	Surface Water	Hexavalent Chromium	Low	(6)	Elizabeth Denly, TRC
IIb	Surface Water	Hexavalent Chromium	Low	Worksheets # 12-12, 15-14, 24, 25, 28-8	Elizabeth Denly, TRC
IIa	Tissue	Metals	Low	(5), (6)	Elizabeth Denly, TRC
IIb	Tissue	Metals	Low	Worksheets # 3 12-5, 15-15, 24, 25, 28-2	Elizabeth Denly, TRC

NA - Not applicable
(1) - Validating Volatile Organic Compounds by SW-846 Method 8260B, HW-24, Revision 2, August 2008, Region 2.
(2) - Validating Semivolatile Organic Compounds by SW-846 Method 8270, HW-22, Revision 4, August 2008, Region 2.
(3) - Data Validation SOP of Organochlorine Pesticides by Gas Chromatography SW-846 Method 8081B, HW-44, Revision 1, October 2006, Region 2.
(4) - Data Validation SOP of Organic Analysis of PCBs by Gas Chromatography SW-846 Method 8082A, HW-45, Revision 1, October 2006, Region 2.
(5) - Evaluation of Metals Data for the CLP Program, HW-2, Revision 13, September 2006, Region 2.
(6) - USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review, EPA 540-R-04-004, October 2004.
* - Up to 25% of the soil, sediment, surface water, and/or tissue data will be subjected to validation.

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17.0 USABILITY ASSESSMENT

17.1 Data Usability

The purpose of this section is to indicate the methods by which it will be ensured that the validated laboratory data collected for this investigation are consistent with the project quality objectives established for the investigation, to ensure the quality of data was sufficient for its intended use, and to identify trends, relationships, and anomalies in the data. Conclusions based on the data, limitations on the use of the data, and the determination if data gaps exist will be included in the data usability assessment. The data usability assessment will be performed by the TRC Project Manager, in conjunction with the TRC Project QA Manager and will be performed after the data validation has been completed.

17.2 Precision

The RPD between the matrix spike and matrix spike duplicate in the case of organic parameters, or sample and sample duplicate in the case of all parameters, is calculated to compare to precision objectives. MS/MSDs and laboratory duplicates will be used to assess analytical precision and the field duplicates will be used to assess project precision. The RPD will be calculated according to the following formula:

$$RPD = \frac{(Amount\ in\ Sample\ 1 - Amount\ in\ Sample\ 2)}{0.5\,(Amount\ in\ Sample\ 1 + Amount\ in\ Sample\ 2)}\ x\ 100$$

The impact of analytical imprecision, project imprecision, and overall imprecision (when both analytical and project precision tests show problems) on data usability will be assessed. If the precision results yield data which are not usable, the data usability assessment will identify how this problem will be resolved and the potential need for resampling will be discussed in the final project report.

17.3 Accuracy

If field or laboratory contamination exists, the impact on the data will be evaluated during the data usability assessment. The direction of bias for contamination will be identified.

In order to assure the accuracy of the analytical procedures, matrix spike samples will be utilized. The increase in concentration of the analyte observed in the spiked sample, due to the addition of a known quantity of the analyte, compared to the reported value of the same analyte in the unspiked sample, determines percent recovery (%R).

Accuracy is similarly assessed by determining %Rs for surrogate compounds added to each field and QC sample to be analyzed for organic parameters. Accuracy for all analyses will be further assessed through determination of %Rs for LCSs and calibration results, etc. If the Data Validation Reports indicate contamination and/or analytical biases, the impact on the data will be assessed.

%R for MS/MSD results will be determined according to the following equation:

$$\%R = \frac{(Amount\ in\ Spiked\ Sample - Amount\ in\ Sample)}{Known\ Amount\ Added} x\,100$$

%R for LCSs and surrogate compound results will be determined according to the following equation:

$$\%R = \frac{Experimental\ Concentration}{Known\ Amount\ Added} x\,100$$

Overall contamination and accuracy/bias will be reviewed for each matrix and analytical parameter. The data usability assessment will include any limitations on the use of the data, if it is limited to a particular matrix, data package, parameter, or laboratory. If the accuracy results yield data which are not usable, the data usability assessment will identify how this problem will be resolved and the potential need for resampling will be discussed in the final project report.

17.4 Representativeness

If field duplicates indicate spatial variability, the data usability assessment will evaluate the impact on the data. Overall sample representativeness will be evaluated for each matrix and analytical parameter by reviewing adherence to sampling procedures, QAPP requirements and audits, if performed. The data usability assessment will include any limitations on the use of the data, if limited to a particular matrix, data package, parameter, or laboratory. If the results of the evaluation of representativeness yield data which are not usable, the data usability assessment will identify how this problem will be resolved and the potential need for resampling will be discussed in the final project report.

17.5 Sensitivity and Quantitation Limits

Overall sensitivity will be reviewed for each matrix and analytical parameter. The impact on the lack of sensitivity or the reporting of higher quantitation limits by the laboratory will be assessed. The data usability assessment will include any limitations on the use of the data, if limited to a particular matrix, data package, parameter, or laboratory. If the results of the evaluation of sensitivity yield data which are not usable, the data usability assessment will identify how this problem will be resolved and the potential need for resampling will be discussed in the final project report.

17.6 Completeness

Completeness is the ratio of the number of valid sample results to the total number of samples analyzed or processed. Following completion of the testing, the percent completeness will be calculated by the following equation:

$$Completeness = \frac{(number\ of\ valid\ measurements)}{(number\ of\ measurements\ planned)} x 100$$

Overall completeness will be reviewed for each matrix and analytical parameter. The goals for field and laboratory completeness are 90% and 95%, respectively. The data usability assessment will include any limitations on the use of the data, if limited to a particular matrix, data package, parameter, or laboratory. If the results of the evaluation of completeness yield data which are not usable, the data usability assessment will identify how this problem will be resolved and the potential need for resampling will be discussed in the final project report.

17.7 Data Limitations and Actions

The field and laboratory data collected during this investigation will be used to achieve the objectives identified in Sections 6.0 and 8.0 of this QAPP. The QC results associated with each analytical parameter for each matrix will be compared to the objectives presented in this QAPP. Data generated in association with QC results meeting the stated acceptance criteria (i.e., data determined to be valid) will be considered usable for decision-making purposes. Limitations on the use of the data will be stated and explained, if necessary.

In addition, the data obtained will be both qualitatively and quantitatively assessed on a project-wide, matrix-specific, and parameter-specific basis. Results of the measurement error assessments will be applied against the site as a whole; any conclusions will be documented in the final report. Data generated in association with QC results not meeting the stated acceptance criteria may still be considered usable for decision-making purposes, depending on certain factors. This assessment will be performed by the TRC Project Manager, in conjunction with the TRC Project QA Manager, and the results presented and discussed in detail in the final report. Factors to be considered in this assessment of field and laboratory data will include, but not necessarily be limited to, the following.

- Conformance to the field methodologies and procedures proposed in the QAPP,
- Conformance to the EPA methods and laboratory SOPs cited in the QAPP,
- Adherence to proposed sampling strategy,
- Presence of elevated detection limits due to matrix interferences or contaminants present at high concentrations,
- Presence of analytes not expected to be present,
- Conformance to validation protocols included in the QAPP for both field and laboratory data,
- Unusable data sets (qualified as “R”) based on the data validation results,
- Data sets identified as usable for limited purposes (qualified as “J”) based on the data validation results,
- Effect of qualifiers applied as a result of data validation on the ability to achieve the project objectives,
- Status of all issues requiring corrective action, as presented in the QA reports to management,
- Effect of nonconformance (procedures or requirements) on project objectives,
- Adequacy of the data as a whole in meeting the project objectives, and

- Identification of any remaining data gaps and need to reevaluate data needs.

Every reasonable attempt will be made to eliminate any sources of sampling and analytical error as early as possible in the program. An ongoing data assessment program throughout the program will also assist in the early detection and correction of problems, thereby ensuring that project objectives are met.

Reconciliation with the project objectives will have been considered to have been met if the measurement performance criteria from Section 6.0 are met. If the data usability indicates that the project quality objectives in Section 8.0 have not been met, then the project management team will meet to determine if additional work needs to be performed.

APPENDIX A

RESUMES

TRC

PATRICK J. HANSEN, PE

EDUCATION
MSCE, Civil Engineering, Lehigh University, 1991
BSCE, Civil Engineering, Lehigh University, 1988

PROFESSIONAL REGISTRATIONS/CERTIFICATIONS
Professional Engineer, Pennsylvania, (#PE044649E), 1994
Professional Engineer, New Jersey, (#24GE03948000), 1995
Professional Engineer, Connecticut, (#18901), 1995
Professional Engineer, Maine, (#P11113), 2007

REPRESENTATIVE EXPERIENCE
As TRC's Director of Operations of the Philadelphia Metro region, Mr. Patrick J. Hansen, PE, has over 20 years of experience in environmental and engineering/construction disciplines, including; environmental programs, investigations and cleanups; permitting, due diligence, landfill closure, and regulatory negotiation. His work included many federal- and state-overseen projects, numerous Fortune 500 private clients; remedial design/planning and cost estimating, and cost recovery/litigation support, and construction.

Mr. Hansen exercised his entrepreneurial skills by opening and running his own firm for over 10 years where he applied his wide-base of skills to the full breadth of project needs associated with environmental projects. Work included sampling programs, regulatory negotiations/interaction, detailed due diligence, binding fixed-price remedial costing including multiple best case/worst case scenarios, cost-cap insurance management, trust fund reporting and equity distributions, remedial design, and construction oversight associated with multi-million dollar cleanups. The technical scope of projects included extensive earthmoving and construction management, landfill multi-media cap (including innovative geotextiles), wetland remediation and restoration, pump and treat scenarios, and industrial site soil capping.

Mr. Hansen has provided expert technical, managerial, and strategic guidance to many projects, including the following:

- Oversight of remediation at a major East Coast petroleum terminal and refinery. Project includes programmatic delineation of operation related impact including soils, ground- and surface-water, and free-product encompassing the 1,000 acres site. Responsibilities include review of design and decision documents, development of action recommendations, and report preparation.

- Development of RCRA Facility Investigation Workplan for chemical manufacturing site located in EPA Region IV. The primary concerns were associated with PCB-laden soils with an estimated liability of $2 billion. Work included review of considerable amounts of historic documentation and site information, strategically focusing proposed investigations, and providing a remedial vision for the site.

- Complete construction oversight for design and remediation of metals impacted soil and groundwater is an estuary environment with NJDEP oversight. Work included the installation of interlocking sheeting immediate adjacent to an ongoing industrial operation building (including noise and vibration monitoring), gross contamination excavation and hazardous materials management, ground water controls, and construction of reinforced concrete facilities lined with geomembranes.

- Modernization of transit authority's passenger train maintenance shop in eastern Pennsylvania. Million-dollar project included temporary sheeting, caisson installation, dewatering, concrete foundations, and procurement and installation of truck and body hoists for married-pair train maintenance. Responsibilities included project management, field resource allocation, material/equipment acquisition, and construction management.

- New Jersey ISRA multi-million dollar cleanup of a former foundry in Cumberland County. This project was a fixed price liability transfer deal. Construction work included major earthwork and capping, geosynthetics, and excavation several feet under a stream, requiring 24/7 pump-around and water management. Preliminary work included consolidating 10-years of investigative information; developing a strategic transfer and closure strategy; a focused soils and groundwater investigation to characterize the contaminants and significantly decrease client's liability; development of Remedial Action Workplan, Stream Encroachment Permit, Soil Erosion Permit.

- Remedial evaluation at multiple large-scale petroleum/ chemical sites under CERCLA, RCRA, or state regulatory programs. Services included program management of major claims. Work included extensive document review, development of site closure strategies, sampling approaches, and engineering cost estimates for various closure concepts. Developed detailed report discussing site conditions, remedial rationale, and justification of costs.

- Construction management activities at a CERCLA mandated, New Jersey DEP supervised 70-acre municipal landfill closure for a PRP group consisting of numerous major corporations. Multi-million dollar site activities included installation of multi-media cap; landfill gas system, and mechanical appurtenances; landfill leachate collection system; and surface-and storm-water controls.

- Remediation of inorganic-laden sediment site in New York. Construction work included sediment removal activities in an Army Corps designated water way, extensive water management, wetland reconstruction, and post-remedial confirmatory sampling.

- Remediation of inorganic-laden sediment and waste rock at a former 85-acres mine site, governed by the Corps of Engineers. Work included design oversight, and heavy construction including major excavation of waste material, wetland remediation in highly-challenging setting due to non-cohesive nature of waste sediments, and construction of a multi-media cap (geonets, geocomposite clay liner, etc.) over the island of waste rock. The site existed in an environmentally sensitive, ecologically-rich setting with active and positive public participation.

- Closure of a state Superfund site in western New York State. Provided complete remedial services at this 25-acre site to cap an industrial landfill containing waste china and to remediate adjacent wetlands impacted with lead. Services included pre-design investigations, complete remedial design including HDPE cap and lined lagoons, and construction management services. Conducted extensive negotiations to substantially reduce project costs. The entire project was fast-tracked in order to avoid the impending regulatory takeover of the project. Devised alternate regulatory protocols and deliverables to greatly accelerate the design schedule to meet client and regulatory objectives.

- Remediation of 3,000 orphan drums located in a New York operating facility. Work included work plan preparation, regulatory interaction, hazardous materials management/shipping/disposal, sampling/characterization, with daily EPA oversight.

- Design and construction management services for a high-profile, CERCLA mandated ground-water remediation system for an aquifer impacted by chlorinated solvents from a specialty chemical manufacturing operation in Massachusetts. The remediation included a ground-water extraction and ultra-violet (UV) oxidation treatment system. Work included advancing caissons/shoring proximate to a building. The system included 22 extraction wells, pneumatically operated extraction pumps, dual air compressors, dual UV-oxidation units, hydrogen peroxide addition unit, remote access telemetry, piping/valves, and mechanical appurtenances.

- Remediation of soil and ground water at a Fortune-500 client site in north Jersey. Project included sheeting/shoring issues, delineation, remedial options analysis and strategic input, preparation of design drawings and bid specifications for excavation and on-site ground water treatment, complete construction oversight, hazardous materials management, site permitting, and regulatory interaction.

- Remedial investigation at an inactive chemical manufacturing facility. The site soil was impacted with PCBs and metals and the ground water was impacted with VOCs and metals. Activities included soil/sediment and ground-water/surface-water sampling and analysis, site characterization, and remedial options evaluation. Responsibilities included data presentation, report preparation, remedial options evaluation/strategic input, regulatory approach, and cost estimates.

- Design for PCB site at former railyard Superfund site involving multiple quasi-governmental PRPs. Project included grading plans, stormwater plans and permits, complete design and specs.

- Complete site investigation resulting in client's release of liability and successful property and liability transfer. Activities at the site included collection and analysis of environmental samples strategic input to property transfer issues, aquifer use studies, tidal studies, report development, and supporting property transfer negotiations.

- Process- and storm sewer stabilization measures project for a Fortune 500 specialty-chemical manufacturing site under EPA oversight. Project included extensive delineation activities, evaluation of current process wastes and sewers, identification of available and appropriate industrial sewer rehabilitation measures, and selection and siting of optimal stabilization measures. The work was performed as an element of a RCRA Corrective Action Permit.

- Investigation, NIR, and work plan development of a Pennsylvania site involving a long industrial history and hazardous compounds in soils and groundwater. The complex site conditions and ongoing, complex site operations created a need for a strategic regulatory approach—dividing the site into better-defined AOCs, leading to efficient site closure.

- Development of regulatory dictated Closure Plan for active industrial waste landfill at an explosives-manufacturing facility in northern New Jersey. Closure included a cap; landfill gas venting; and erosion, surface- and storm-water piping, channels, and control structures.

- Construction of a wastewater treatment plant retrofit for a municipality in central New Jersey. Retrofit features included major excavation, a sequential batch reactor (SBR) treatment system consisting of CIP-concrete treatment tanks, aeration equipment, skimmers, sludge pumps and holding tanks, ultra-violet (UV) disinfection, low lift pump station, blowers, controls, telemetry, various large and small-diameter piping and valves, and mechanical appurtenances. Responsibilities included project management, field resource allocation, material/equipment acquisition, and construction management.

TRC
Results you can rely on

JORGE I. GOMEZ, CPG, LSRP

EDUCATION

B.S., Geology, The City University of New York, York College, 1988

PROFESSIONAL REGISTRATIONS/CERTIFICATIONS

Certified Professional Geologist, American Institute of Professional Geologists License CPG-09509
Professional Geologist - Commonwealth of PA, License No. PG-003185-G
NJDEP Subsurface Investigation, Underground Storage Tank (UST) License No. 0010902
NJDEP- LSRP

AREAS OF EXPERTISE

Mr. Jorge I. Gomez, CPG, LSRP has program management and technical experience in the following general areas:

- Environmental Assessments and Audits
- Underground Storage Tank Management
- Site Remediation Design and Implementation
- Groundwater Remediation
- Solid Waste Management
- Remedial investigations at State and Federal Superfund sites
- Design of ground-water monitoring and recovery systems
- Preparation of expert reports
- Ground-water exploration programs in unconsolidated and bedrock aquifers
- Interpretation and analysis of aquifer pumping test data
- Preparation of RI Workplans and RI Reports

REPRESENTATIVE EXPERIENCE

Mr. Gomez has over 20 years of experience environmental and groundwater supply consulting. He has managed numerous soil and ground water investigations projects at chemical plants, oil refineries, manufacturing facilities, and gas service stations in the Eastern United States, South America, the Caribbean, and Africa. His responsibilities include evaluation of technical documents and review of facility compliance, waste disposal issues, meeting with clients, attorneys and regulatory agencies, subcontractor hiring and scheduling, groundwater investigations in unconsolidated and bedrock formations, implementation of monitoring programs and data management, preparation of preliminary assessments, preparation of remedial investigation reports (RIR) and remedial action workplans (RAW), preparation of underground storage tank (UST) closure reports, and preparation of expert reports in support of the environmental litigation.

Soil and Groundwater Investigation/Remediation

Exxon Refinery, Soil and Groundwater Investigation - Bayway Refinery, New Jersey (Assistant Manager: 1990 – 1992)

Assisted with the preparation of a remedial investigation workplan (RIW) and coordinated the field activities, which included installation of numerous soil borings and monitoring wells to characterize the soil and ground water conditions at the site.

NJDEP Parks and Forestry, UST Closures and UST/AST installations - State Parks, Central and Northern New Jersey (Project Manager: 1998 – 2000)

Managed large-scale underground storage tank (UST) projects in the State of New Jersey. Tasks associated with these projects included preparation of bid specifications, construction management, preparation of air permits, contractor coordination and scheduling, UST removals, design and installation of UST and above ground storage tanks (AST), soil remediation, post-excavation sampling activities, and report preparation.

Ridgemont Shopping Center, Site and Remedial Investigation – Park Ridge, NJ (Project Manager: 2002 – 2005)

As a project manager, Mr. Gomez was responsible for investigation of chlorinated compounds that were detected in the borough's water supply wells. The site investigations included preparation of soil and groundwater investigation workplans, soil investigations and installation of monitoring wells in the unconsolidated and bedrock formations to evaluate the extent of the chlorinated volatile organic compounds (VOC) plume and groundwater flow direction. Mr. Gomez met with State representatives and coordinated the site and remedial investigation activities, and prepared the remedial investigation reports.

Former Forklift Manufacturer, Site Characterization and Remediation – Philadelphia, PA (Program Manager: 2006 – 2009)

Mr. Gomez was responsible for investigation and remediation of soils and groundwater impacted from a gasoline UST. Tasks associated with this project included UST removal, excavation and disposal of contaminated soils, groundwater pumping and treatment, installation of monitoring wells, groundwater sampling, preparation of progress reports, fate and transport model, and final characterization report.

New Jersey Transit, Soil and Groundwater Investigation – City of Trenton, NJ (Program Manager: 2006 – 2009)

Coordinated and managed remedial investigations and remedial actions at a former New Jersey Transit site. Prior to conducting the field activities, historical data and environmental reports were reviewed to evaluate the areas of concern (AOC) and contaminants present in those areas. The remedial investigations

and remedial actions conducted at the site included: closure of an oil/water separator system, soil remediation in two AOCs, recovery of impacted groundwater, monitoring well installation, quarterly groundwater sampling, and preparation of a remedial investigation and remedial action report. A classification exception area (CEA) as an institutional control was proposed as the remedial action for the groundwater at the site.

SMC, Exit Strategy – Newfield, NJ (Project Manager: 2010 – Present)
Mr. Gomez serves as Project Manager for multiple task exit strategy project and he is involved in a wide variety of assignments including preparation of cost estimates, coordination with subcontractors, soil and groundwater investigations, compliance with New Jersey Pollutant Discharge Elimination System (NJPDES) permit, evaluation of environmental report and data, and preparation of Field Sampling Plan (FSP).

Groundwater Exploration

Sun Oil Refinery, Well Redevelopment and Pumping Tests – Puerto Rico (Project Manager: 1988 – 1990)

Mr. Gomez assisted with the rehabilitation of water supply wells for an oil refinery in Puerto Rico. He was also responsible for conducting ground water exploration programs, data collection, supervision of test drilling, performance of step-drawdown and long term pumping tests and report preparation.

City of East Orange, Ground Water Exploration - East Orange, NJ (Project Manager: 1995 – 1998)

Mr. Gomez conducted an extensive ground water exploration in glacial deposits and bedrock formation. Tasks associated with the project included drilling of test wells, preparation of a hydrogeologic test proposal, borehole logging, mapping, performance of aquifer test, and data analysis, preparation of a water allocation permit, and preparation of a hydrogeologic report.

Warren County, Hydrogeologic Studies – Warren County, NJ (Project Manager: 2004)

Compiled hydrogeologic data to assist two townships in Warren County, New Jersey with the evaluation and management of the ground water resources and environmental issues.

SPECIALIZED TRAINING

- Forty-Hour OSHA Health and Safety Training, 1988
- Basic GIS Concepts, University College, Denver, Colorado. Spring 2004
- DOT/HM-126F HAZMAT Training 49CFR 172, subpart H, 2005
- Waste Management Employee Training Program 40 CFR 265.16, 2005

- EPA/AHERA/New Jersey Asbestos Contractor/Supervisor, August 2005
- EPA/AHERA/Pennsylvania Asbestos Building Inspector, November 2005
- Site Remediation Basics, December 2009

PROFESSIONAL AFFILIATIONS

- American Institute of Professional Geologist

SELECTED PUBLICATIONS AND PRESENTATIONS

Gomez, J. and Uhl, V.W., 1990. Quantifying Well Redevelopment Efforts: Paper presented at International Ground water Engineering Conference on Water Well Monitoring, Maintenance and Rehabilitation in Cranfield, U.K.

TRC

KAREN M. VETRANO, Ph.D.

EDUCATION

Ph.D., Toxicology, University of Connecticut, 1992
B.S., Toxicology, Northeastern University, 1986

AREAS OF EXPERTISE

Dr. Karen M. Vetrano has 19 years of experience encompassing:

- Expert Testimony and Litigation Support
- Human Exposure and Risk Assessment
- Ecological Hazard Characterization and Risk Assessment
- Environmental Fate and Transport
- Toxicological Evaluations
- TSCA PMN Submissions
- Exposure Assessments
- Odor Evaluation
- Indoor Air Quality Investigations

REPRESENTATIVE EXPERIENCE

Dr. Vetrano manages TRC's Risk Assessment and Toxicology Practice as well as the Odor Evaluation and Control Groups. She supervises and provides Senior Level support for projects that include human health and ecological risk assessments, toxicological evaluations, exposure assessments, labeling and preparation of material safety data sheets (MSDS), odor evaluation, indoor air quality and industrial hygiene program reviews. Dr. Vetrano also provides expert witness and litigation support services for risk assessment, odor and lead poisoning issues.

Dr. Vetrano provides management and technical support for the various components of human exposure and health risk assessments under such programs as Superfund, Resource Conservation and Recovery Act (RCRA), California Proposition 65, the Massachusetts Contingency Plan (MCP) (as well as other individual State programs) and EPA's Brownfield Program. The general components in these assessments include validation of data, modeling of environmental concentrations, identification of relevant land uses and activities, assessment of chemical intakes, evaluation of chemical toxicity and characterization of potential health risks from chemical exposures.

Expert Testimony and Litigation Support

Confidential Law Firm, Toxicological Support – NY (Project Manager and Toxicologist: 2005-2008)

Dr. Vetrano is providing toxicological support and Expert Witness services for a lawsuit in which plaintiff is contending his occupational exposure to metals caused his colon cancer. She reviewed corporate MSDSs, hazardous communications information, and internal documentation as well as plaintiff's

medical information. She has provided expert reports and provided testimony in a deposition.

Various Confidential Law Firms, Toxicological Support – NY (Toxicologist: 2005-Present)
Dr. Vetrano is providing toxicological support in a number of lead poisoning cases. She is representing defendants, by providing blood lead modeling to determine if living spaces are a source of lead poisoning or if alternative sources of lead are possible.

Confidential Client, Major Petrochemical Firm, Risk Assessment Support – TX (Project Manager and Lead Risk Assessor: 2004-Present)
Dr. Vetrano is providing risk assessment support in response to litigation. Community is suing firm as a result of 1955 gasoline spill which contaminated groundwater under the town. Risk assessment conducted showing no vapor intrusion into homes and thus no risk. Dr. Vetrano is providing expert testimony as needed.

Confidential Client, Consumer Product Manufacturer, Comparative Odor Evaluation – NJ (Project Manager: 1994)
Dr. Vetrano designed and performed comparative odor evaluation studies to evaluate the efficacy of consumer odor control product versus competing brand as part of a false advertising suit. She represented the client and provided testimony in deposition and court room.

Human Exposure and Risk Assessment – Hazardous Waste Sites

Confidential Client, Former Illegal Dump Site, Human Health Risk Assessment – NJ (Task Manager and Lead Risk Assessor: 2003-Present)
Dr. Vetrano is currently serving as Task Manager for a comprehensive baseline human health risk assessment for a Superfund site in New Jersey. The site is a former illegal dumping site at which PCBs are the primary contaminant of concern. A human health risk assessment to evaluate recreational exposures to surface water, soils, local game will be conducted. The results of the risk assessment will be used by the client to develop potential remedial solutions at the site.

Confidential Client, FAA, Human Exposure and Risk Assessment – NJ (Task Manager and Lead Risk Assessor: 1996-Present)
Dr. Vetrano is performing a qualitative and quantitative assessment of risks to human and ecological receptors potentially impacted by activities conducted at a federal facility site in New Jersey. She is providing technical support in the quantification of risks from multiple exposure pathways (dermal absorption following contact with soil and water, and ingestion of contaminated soils and drinking water sources) and current and future land use scenarios. She also conducted risk assessments at numerous AOCs on site.

Confidential Client, Former Landfill Site, Human Health Risk Assessment – NJ (Task Manager and Lead Risk Assessor: 2008-Present)
Dr. Vetrano is currently serving as Task Manager for a comprehensive baseline human health risk assessment for a Superfund site in New Jersey. The site is a former landfill at which low-level PAHs are the principal contaminants of concern. A human health risk assessment to evaluate recreational exposures to surface water, sediments, soils, and local game will be conducted. The results of the risk assessment will be used by the client to develop potential remedial solutions at the site.

Confidential Client, Phosphate Mine, Human Health Risk Assessment – Southeastern ID (Task Manager and Lead Risk Assessor: 1996-Present)
Dr. Vetrano completed a comprehensive baseline human health risk assessment for a former phosphate mine located near the Blackfoot River in southeast Idaho. Tailings from the mining operation resulted in the leaching of selenium into surface waters of a nearby stream. A human health risk assessment to evaluate recreational exposures to surface water, soils, local game was conducted. The results of the risk assessment are being used by the client to develop potential remedial solutions at the site.

Confidential Client, Railroad Yard, Human Health Risk Assessment – Iowa (Task Manager and Lead Risk Assessor: 2002-2008)
Dr. Vetrano served as Task Manager for a comprehensive baseline human health risk assessment for a railroad yard in Iowa, where chlorinated solvents are the primary contaminant of concern. A human health risk assessment to evaluate exposures to soils, sediments, surface water and ground water was conducted. An indoor air quality survey and risk assessment was conducted for the locomotive rebuild facility under which a plume of PCE is located. Results of the study indicated that there are no significant volatilization issues within the facilty.

Confidential Client, Former Refinery Site, Human Exposure and Risk Assessment – MT (Project Manager and Lead Risk Assessor: 1999-2009)
Dr. Vetrano conducted a human exposure and risk assessment pertaining to ground water contamination at a former refinery. Residential and school indoor air concentrations were directly measured and incorporated into a human health risk assessment. Dr. Vetrano represented the client in meetings with state regulatory agency as well as public meetings. She has also provided expert witness support during litigation.

Confidential Client, Former MGP Site, Human Exposure and Risk Assessment – Eastern MA (Task Manager and Lead Risk Assessor: 2001-2003)
Dr. Vetrano conducted a Method 3 risk assessment under the MCP at a former MGP site, which is to be the future site of a middle school. The general components in this assessment included validation of data, modeling of environmental concentrations, identification of relevant exposure scenarios,

assessment of chemical intakes, evaluation of chemical toxicity and characterization of potential health risks from chemical exposures. EPA's Johnson and Ettinger Model was used to evaluate the risks from indoor air from the volatilization of constituents into indoor air. The results of the risk assessment were used to assess whether a level of no significant risk existed with respect to the soil and ground water conditions present at the site.

Confidential Client, Former Tie Treating Facility, Human Exposure and Risk Assessment – NM (Task Manager and Lead Risk Assessor: 1996-2002)
Dr. Vetrano conducted a human exposure and risk assessment pertaining to soil and ground water contamination at a former tie treating facility. She provided technical support in the quantification of risks from multiple exposure pathways (dermal absorption following contact with soil and water, and ingestion of contaminated soils and drinking water sources, and inhalation of volatiles from soil and ground water using EPA's Johnson and Ettinger models) and current and future land use scenarios. Risk assessment provided risk-based clean up levels to be used in the feasibility study. Dr. Vetrano represented the client in meetings with state regulatory agency and EPA Region VI.

Confidential Client, Manufacturing Facility, Human Exposure and Risk Assessment – Southern CT (Task Manager and Lead Risk Assessor: 1998-1999)
Dr. Vetrano conducted a human exposure and risk assessment pertaining to ground water contamination at a manufacturing facility. Residential indoor air concentrations were modeled from the volatilization of VOCs from ground water and incorporated into a human health risk assessment using the Johnson and Ettinger model. Additionally, direct measurement of indoor air concentrations from the facility itself were also incorporated into the evaluation of risk to current workers.

Confidential Client, Brownfield Site, Human Exposure and Risk Assessment – Southern CT (Task Manager and Lead Risk Assessor: 1999-2000)
Dr. Vetrano conducted a human exposure and risk assessment pertaining to soil contamination at a former manufacturing facility. An immediate hazard evaluation was conducted due to presence of elevated soil contaminants on-site and the use of the site as a play area for nearby resident children. The results of the evaluation prompted the municipality to fence off the site to prohibit access to the site. Dr. Vetrano participated in public meeting to discuss risk assessment results.

U.S. Naval Education and Training Center (NETC), Human Health Risk Assessments – Newport, RI (Risk Assessor: 1992)
Dr. Vetrano performed multiple pathway health risk assessments on five Superfund sites at the NETC. She provided technical support in the quantification of risks from multiple exposure pathways (inhalation of fugitive dusts and volatile gases, dermal absorption following contact with soil, sediment and water, and ingestion of contaminated dusts, soils, sediments, shellfish, and drinking water sources) and current and future land use scenarios.

Naval Construction Battalion Center (NCBC), Health Risk Assessments – Davisville, RI (Risk Assessor: 1993)
Dr. Vetrano performed multiple pathway health risk assessments on Superfund sites at the NCBC. She provided technical support in the quantification of risks from multiple exposure pathways (inhalation of fugitive dusts and volatile gases, dermal absorption following contact with soil, sediment and water, and ingestion of contaminated dusts, soils, sediments, and drinking water sources) and current and future land use scenarios.

Confidential Client, Utility Site, Human Exposure and Risk Assessment – Eastern MA (Risk Assessor: 1998)
Dr. Vetrano conducted a Method 3 risk assessment under the MCP. The general components in this assessment included validation of data, modeling of environmental concentrations, identification of relevant exposure scenarios, assessment of chemical intakes, evaluation of chemical toxicity and characterization of potential health risks from chemical exposures. The results of the risk assessment were used to assess whether a level of no significant risk existed with respect to the soil and ground water conditions present at the site.

Confidential Client, Shooting Range, Human Exposure and Risk Assessment – Western MA (Risk Assessor: 1996-2002)
Dr. Vetrano conducted a Method 1 risk assessment under the MCP. The general components in this assessment included validation of data, modeling of environmental concentrations, and identification of relevant exposure scenarios pertaining to lead and PCB exposure. The results of the risk assessment were used to assess whether a level of no significant risk existed with respect to the soil conditions present at the site.

Confidential Client, Trucking Facility, Human Exposure and Risk Assessment – Eastern MA (Risk Assessor: 1998-1999)
Dr. Vetrano conducted a Method 1 risk assessment under the MCP. The general components in this assessment included validation of data, modeling of environmental concentrations and identification of relevant exposure scenarios. The results of the risk assessment were used to assess whether a level of no significant risk existed with respect to the soil and ground water conditions present at the site.

Confidential Client, Trucking Facility, Human Exposure and Risk Assessment – Western MA (Risk Assessor: 1998-1999)
Dr. Vetrano conducted a Method 1 and Method 3 risk assessment under the MCP. The general components in this assessment included validation of data, modeling of environmental concentrations, identification of relevant exposure scenarios, assessment of chemical intakes, evaluation of chemical toxicity and characterization of potential health risks from chemical exposures. The results of the risk assessment were used to assess whether a level of no significant risk

existed with respect to the soil, ground water and indoor air conditions present at the site.

Human Exposure and Risk Assessment – Air Toxics

Confidential Client, Munitions Incinerator, Multipathway Human Health and Ecological Risk Assessments – NV (Project Manager and Lead Risk Assessor: 2006-Present)
Dr. Vetrano is currently providing technical expertise to assess the risks from the emissions from munitions incinerators located in Nevada. A protocol for the multiple pathway human health and ecological risk assessments, which follow current EPA and state guidance for hazardous waste incinerators/combustion emissions, has been submitted and approved by the appropriate regulatory agencies. Once the Trial Burn has been conducted, Dr. Vetrano will perform site-specific risk assessment modeling and provide technical expertise in the areas of identification and assessment of multiple routes of exposure, including inhalation, ingestion of locally produced foodstuffs (vegetables, beef and dairy) and locally caught fish.

Confidential Client, Specialty Chemicals Manufacturer, Multipathway Human Health and Ecological Risk Assessments – NY (Task Manager and Lead Risk Assessor: 1996-Present)
Dr. Vetrano is currently providing technical expertise to assess the risks from the emissions from a rotary kiln and a fixed box incinerator located in upper state New York. A protocol for the multiple pathway human health and ecological risk assessments, which follow current EPA and state guidance for hazardous waste incinerators/combustion emissions, was been prepared and submitted to the appropriate regulatory agencies. Upon approval, Dr. Vetrano prepared a site-specific risk assessment which included risk assessment modeling and provided technical expertise in the areas of identification and assessment of multiple routes of exposure, including inhalation, ingestion of locally produced foodstuffs (vegetables, beef and dairy) and locally caught fish. Constituents of potential concern included metals (including mercury), chlorine, volatile organic compounds, semivolatile organic compounds, PCBs and dioxins. She worked closely with the client to ensure a technically sound product suitable for EPA and state agency submission.

Confidential Client, Cement Plant, Toxicological Evaluation – Ravena, NY (Project Manager and Toxicologist: 2005)
Dr. Vetrano provided a toxicological evaluation of emissions from a cement plant that proposed to burn TDF as fuel. She represented the client during public meetings and responded to public comments as part of the successful permitting process.

Confidential Client, Human Exposure and Risk Assessment, 90 Church Street Site – New York, NY (Project Manager and Lead Risk Assessor: 2002-2003)

Dr. Vetrano conducted a human exposure and risk assessment pertaining to indoor environmental contamination as a result of the World Trade Center disaster. She evaluated indoor air and dust wipe sample data obtained from eight floors of the building. The data was incorporated into a site-specific human health risk assessment following EPA guidelines. The human health risk assessment was conducted to provide a site-specific evaluation of the current environmental conditions in the workspaces and common areas at 90 Church Street in order to support insurance claims for clean-up of the building interior. Dr. Vetrano evaluated and commented on contractor's proposed clean-up plans and clean-up levels.

Confidential Client, Human Exposure and Risk Assessment, One Liberty Plaza Site – New York, NY (Project Manager and Lead Risk Assessor: 2001-2002)

Dr. Vetrano served as Task Manager for a human exposure and risk assessment pertaining to indoor environmental contamination as a result of the World Trade Center disaster. She evaluated indoor air and dust wipe sample data obtained from eight floors of the building. The data was incorporated into a site-specific human health risk assessment following EPA guidelines. The human health risk assessment was conducted to provide a site-specific evaluation of the current environmental conditions in the workspaces and common areas at One Liberty Plaza in order to determine whether or not it was safe to re-occupy the workspace. Dr. Vetrano participated in employee public meetings to present findings of the human health risk assessment and answer concerned employee questions.

Confidential Client, Proposed Power Plants, Exposure Assessment and Multipathway Human Health Risk Assessments – Various Sites, NY (Lead Risk Assessor: 2000-2005)

Dr. Vetrano provided technical expertise to assess the risks from the emissions from proposed power plants to be located in New York State. She evaluated the proposed short-term and long-term air emissions as required under the Stipulations as part of the Article X submission to the state. As part of this evaluation, she has identified risk-based air concentration benchmarks required for the evaluation. If required, multiple pathway human health risk assessments, which follow current EPA and state guidance for hazardous waste incinerators/combustion emissions, were conducted. Dr. Vetrano performed site-specific risk assessment modeling and provided technical expertise in the areas of identification and assessment of multiple routes of exposure, including inhalation, ingestion of locally produced foodstuffs (vegetables, beef and dairy) and locally caught fish.

Confidential Client, Specialty Chemical Manufacturers, Multipathway Human Health Risk Assessments – Various Sites (Project Manager and Lead Risk Assessor: 1994-2002)

Dr. Vetrano served as a Task/Project Manager for ten separate projects, which assessed the risks from the emissions from hazardous waste incinerators located

around the United States. Specific locations included New York, Tennessee, Louisiana, Kansas, Missouri, and West Virginia. She prepared a Risk Assessment Protocol and conducted multiple pathway human health risk assessments which followed current EPA and state guidance for hazardous waste incinerators/combustion emissions. Dr. Vetrano identified current and future land uses and activities in areas around the site through site visits and verbal/written contact with various state, county and local agencies. Recreational use of ponds and streams, beef and dairy farming and residential land use were among the local land uses and activities identified. Dr. Vetrano performed site specific risk assessment modeling and provided technical expertise in the areas of identification and assessment of multiple routes of exposure, including inhalation, ingestion of locally produced foodstuffs and locally caught fish, dermal exposure and ingestion of mother's milk. She worked closely with clients to ensure a technically sound product suitable for EPA and state agency submission.

Confidential Client, Alternative Fuel Burning Cement Kiln, Human Health Risk Assessment – NY (Risk Assessor: 1994)
Dr. Vetrano performed an assessment of the risks to human health from the emissions from a cement kiln, requested for compliance under RCRA. The multiple pathway human health risk assessment involved the quantitation of doses and risks from current and future activities based on a realistic maximum exposure scenario.

Human Exposure and Risk Assessment – Product Evaluations

New York City Department of Health and Mental Hygiene (NYCDOHMH), Human Exposure Evaluation, Literature Review of Crumb Rubber Infill – NY (Project Manager and Toxicologist: 2007-2008)
Dr. Vetrano managed and participated in a large literature review of the potential health and safety risks of synthetic turf crumb rubber infill which is manufactured from recycled tires. The review encompassed the chemical make-up of the infill material, including the constituents of potential concern, health risk information and potential safety issues. The NYCDOHMH published the report entitled "A Review of the Potential Health and Safety Risks from Synthetic Turf Fields Containing Crumb Rubber Infill" on their website.

New York City Department of Health and Mental Hygiene (NYCDOHMH), Air Sampling and Human Health Evaluation, Crumb Rubber Infill – NY (Project Manager and Toxicologist: 2008-2009)
Dr. Vetrano managed and provided toxicological support for an air quality survey conducted at two synthetic turf fields in New York City. This project was in response to the literature review study that identified data gaps in the knowledge base of crumb rubber, namely the lack of air data quantifying emissions over synthetic turf fields with crumb rubber infill. TRC conducted air sampling over a three day period at 2 synthetic turf fields. In addition, ambient air and surface

temperature readings were conducted. The concentrations of constituents of concern detected in the air samples were compared to background and New York air guidelines. No constituents were considered to be at a concentration considered to be a health concern and none exceeded background conditions. The NYCDOHMH published the report entitled "Air Quality Survey of Synthetic Turf Fields Containing Crumb Rubber Infill" on their website.

Confidential Client, City Agency –Human Health Evaluations, Crumb Rubber Infill - NY (Toxicologist: 2009)
Dr. Vetrano provided toxicological support to a City agency interested in the use of synthetic turf fields with crumb rubber infill. Dr. Vetrano reviewed installer specifications and assisted in the development of guidelines for the installers to insure the use of a safe product.

Confidential Client, Consumer Product Company, Human Exposure and Risk Assessment – NJ (Project Manager and Risk Assessor: Present)
Dr. Vetrano is conducting a human exposure assessment of a class of consumer products to support a Safe Use Determination under Proposition 65. She monitored for alpha-quartz exposure during the use of numerous brands of the product. She also calculated a time weighted exposure for dust and alpha-quartz exposures and evaluated the potential health risks resulting from alpha-quartz exposure during the use of this product.

Confidential Client, Trade Association, Human Exposure and Risk Assessment – Washington, DC (Project Manager and Risk Assessor: 1996-1998)
Dr. Vetrano conducted a human exposure assessment of a class of consumer products to support a Safe Use Determination under Proposition 65. She monitored for alpha-quartz exposure during the use of numerous brands of the product. Dr. Vetrano also calculated a time weighted exposure for dust and alpha-quartz exposures and evaluated the potential health risks resulting from alpha-quartz exposure during the use of this product.

Confidential Client, Product Evaluation, Human Exposure and Risk Assessment –CT (Project Manager and Risk Assessor: 1998)
Dr. Vetrano conducted a human exposure assessment for a consumer product to determine labeling requirements under Proposition 65. She monitored for alpha-quartz, carbon monoxide and polyaromatic hydrocarbon exposure during the use of this consumer product. Dr. Vetrano conducted a risk assessment under Proposition 65 to determine whether a level of no significant risk existed with the use of this product. She also calculated a time weighted exposure for alpha-quartz exposure and evaluated the potential health risks resulting from alpha-quartz exposure during the use of this product.

Confidential Client, Chemical Manufacturer, Human Exposure Studies to MTBE, Specialty – PA (Toxicologist: 1994-2000)
Dr. Vetrano assisted in the development and management of human exposure studies to methyl tertiary butyl ether (MTBE) in conjunction with Yale University's Pierce Laboratory. Additional tasks involved in this project included the evaluation of risks to human subjects exposed to gasoline vapors in controlled exposure studies. An extensive literature search and evaluation of adverse effects reported from inhalation exposure to gasoline, C4C6 alkenes (olefins) and simple ethers were also conducted. While human data was emphasized, animal data was also used.

Ecological Hazard Characterizations and Risk Assessments

Confidential Client, Petroleum Refinery, Ecological Endangerment Assessment – WY (Risk Assessor: 1998-2002)
Dr. Vetrano performed a semi-quantitative evaluation of constituent levels in river sediments to assess the impact to aquatic receptors. The goal of this evaluation was to aid in the placement of a permanent impermeable barrier wall along the bank of the river as an Interim Measure to prevent residual contaminants in bank soils and sediments from adversely impacting the quality of the river.

Confidential Client, FAA, Ecological Risk Assessment – NJ (Risk Assessor: 1999)
Dr. Vetrano performed a qualitative and quantitative assessment of risks to ecological receptors potentially impacted by activities conducted at a federal facility site in New Jersey. She assisted in the selection of potential constituents of concern in surface soil, sediments and surface water. Potential impacts were evaluated for both aquatic and terrestrial receptors using a combination of chemical and toxicity data collected in the field and a food chain modeling approach to assess bioaccumulation potential of the constituents of concern.

Confidential Client, Industrial Facility, Ecological Risk Assessment – NJ (Risk Assessor: 1999)
Dr. Vetrano performed a qualitative and quantitative assessment of risks to ecological receptors potentially impacted by activities conducted at an industrial site in New Jersey. She assisted in the selection of potential constituents of concern in surface soil, sediments and surface water. Potential impacts were evaluated for both aquatic and terrestrial receptors using a combination of chemical and toxicity data collected in the field and a food chain modeling approach to assess bioaccumulation potential of the constituents of concern.

U.S. Naval Education and Training Center (NETC), Ecological Risk Assessments – Newport, RI (Risk Assessor: 1993)
Dr. Vetrano performed ecological risk assessments on five Superfund sites at the NETC. She provided technical support in the quantification of risks to aquatic

and terrestrial receptors using a combination of chemical and toxicity data collected in the field and food chain modeling.

Confidential Client, Alternative Fuel Burning Cement Kiln, Ecological Risk Assessment – NY (Risk Assessor: 1994)
Dr. Vetrano performed an assessment of the risks to ecological receptors from the emissions from a cement kiln, requested for compliance under RCRA. The ecological assessment involved a variety of inorganic and organic pollutants whose presence in water, air, soils and sediments was evaluated in relation to the at risk plant and animal (both aquatic and terrestrial) receptor species.

Confidential Client, Environmental Endangerment Assessment, Long Island Sound – CT (Risk Assessor: 1993)
Dr. Vetrano performed numerous water discharge assessments for Long Island Sound and tidal rivers, focusing upon the potential for drilling mud releases to damage benthic habitats. She evaluated the potential environmental endangerment by this drilling mud on the habitats, food sources and reproduction of the affected benthic organisms as well as subsequent re-colonization of the impacted areas by these species.

Toxicological Evaluations

Confidential Client, City Agency, Health Review, New York (Project Manager and Toxicologist: 2007-present)
Dr. Vetrano is currently performing an assessment of the physical and health risks of the use of crumb rubber from recycled tires in synthetic turf playing fields. Dr. Vetrano is conducting a comprehensive review of the literature to identify the hazards associated with the use of crumb rubber as well as the data gaps. A sampling protocol to address the data gaps will be developed subsequent to the development of a report to assist the City Agency in making recommendations on the use of crumb rubber.

Confidential Client, Toy Manufacturer, Art Materials Labeling Review – Colchester, CT (Project Manager and Toxicologist: 2/2006)
Dr. Vetrano performed an assessment of chronic risks associated with the ingredients of three paints used in children's art supplies. The assessment was conducted in accordance with ASTM Practice D-4236.

Confidential Client, Toy Manufacturer, Art Materials Labeling Review – Irwindale, CA (Project Manager and Toxicologist: 8/2003)
Dr. Vetrano performed an assessment of chronic risks associated with the ingredients of crayons used in children's art supplies. The assessment was conducted in accordance with ASTM Practice D-4236.

Confidential Client, Consumer Product Manufacturer, Toxicological Support and Preparation of Material Safety Data Sheets (MSDSs) – Cincinnati, OH (Project Manager and Toxicologist: 1994-1998)

Dr. Vetrano provided toxicological support to a nationwide consumer product manufacturer by reviewing toxicological study and chemical analysis reports for the review and revision of, or preparation of, product MSDSs for compliance with OSHA and SARA Title III.

The Chlorine Institute, Inc., Review of Toxicological Literature and Preparation of Health Effects Summary Document – Washington, DC (Project Manager and Toxicologist: 1997-1998)
Dr. Vetrano performed a comprehensive review of the toxicological literature for the health and environmental effects of molecular chlorine. She prepared a health effects summary document which has been published by the Chlorine Institute as Pamphlet 90: Molecular Chlorine: Health and Environmental Effects (November, 1998).

Center for Disease Control, Agency of Toxic Substances and Disease Registry Peer Review Services – Atlanta, GA (Toxicologist: 1994-1998)
Dr. Vetrano provided peer review expertise for the Center for Disease Control, Agency of Toxic Substances and Disease Registry (ATSDR) to meet the requirements of CERCLA Section 104(I)(13). She provided a review of grant proposals written by state health officials or university affiliated investigators and evaluated project strengths and weaknesses, the extent of feasibility and appropriateness of the proposed research plan, and demonstration that the results will add significant new information to the scientific community and have the potential for publication.

Center for Indoor Air Research, Peer Review Services – MD (Toxicologist: 1994-1998)
Dr. Vetrano provided peer review expertise for the Center for Indoor Air Research (CIAR). She provided a review of grant proposals written by state health officials or university affiliated investigators and evaluated project strengths and weaknesses, the extent of feasibility and appropriateness of the proposed research plan, and demonstration that the results will add significant new information to the scientific community and have the potential for publication.

Confidential Client, Specialty Chemicals Manufacturer, Review of Toxicological Literature and Studies and Preparation of Toxicological Profiles – WV (Toxicologist: 1994-1996)
Dr. Vetrano provided support to a nationwide specialty chemicals manufacturer by reviewing toxicological study protocols and reports, preparing health effects statements for pre-manufacturing notification for proposed products and toxicological summary reports for current products. Summary reports are based on a review of toxicological literature for each product and an evaluation of the results of recent toxicological studies. Reviews and revises the material safety data sheets (MSDSs) for products for compliance with OSHA and SARA Title III.

Silicones Environmental Health and Safety Council of North America (SEHSC), Critical Review of Data – Washington, DC (Study Manager and Toxicologist: 1994-1996)
Dr. Vetrano managed the extensive review and summary of the health and safety studies submitted on the 56 siloxanes covered in the TSCA Section 8(d) Reporting Rule. She assisted in the organization and summarization of environmental and toxicological data from the greater than 2000 reports that were submitted on these chemicals into data summaries, compiled by siloxane class, to provide overview information. Dr. Vetrano provided succinct, accurate summarizations of health and environmental impacts of individual materials, and by class, prepared summary text, and reviewed the database used to track the thousands of studies/reports.

Confidential Client, Major Adhesives Manufacturer, Chemical Toxicity Review – CT (Project Manager and Toxicologist: 1994-1996)
Dr. Vetrano performed an annual review of the toxicity of more than 500 chemicals used in adhesive manufacturing. She utilized toxicological expertise in the evaluation and interpretation of the toxicological data for these chemicals.

Environmental Research Group (ERG)/EPA, Toxicological Literature Evaluation – Washington, DC (Toxicologist: 1992)
Dr. Vetrano performed a comprehensive review of the toxicological literature for contact-site carcinogens for ERG/EPA. She provided technical support by critically evaluating the existing toxicological literature for contact-site carcinogens and conducted literature searches using online computer toxicology databases.

EPA's Office of Air Quality Planning and Standards, Toxicological/ Pharmacokinetic Database Evaluation – Washington, DC (Toxicologist: 1992)
Dr. Vetrano assisted in developing a route-to-route extrapolation of cancer potency factors used in risk assessments. She provided technical support by critically evaluating toxicological and pharmacokinetic databases to determine the validity of extrapolating oral-based cancer potency estimates to the inhalation route. She focused on hazardous air pollutants listed in the Clean Air Act Amendments.

Confidential Client, Specialty Chemical Manufacturer, Toxicological Support Services – Newtown Square, PA (Project Manager and Toxicologist: 1993-1996)
Dr. Vetrano provided toxicological support services required to conduct an ethyl tertiary butyl ether (ETBE) testing program to acquire toxicology data in advance of its potential use as a fuel oxygenate. She assisted in the design of the testing program that was devised to screen for effects in standardized subchronic, reproductive, developmental, neurotoxicity, pharmacokinetic and mutagenicity studies. As part of the support services, Dr. Vetrano had been involved in

protocol development, study placement at toxicological facilities, project oversight, and data and report reviews.

TSCA PMN Submissions

Confidential Client, Specialty Materials Manufacturer, PMN Preparation Services, Rogers, CT (Project Manager and Toxicologist: 2000, 2005)
Dr. Vetrano provided PMN preparation services required to request a Low Volume Exemption (LVE) for their materials. Dr. Vetrano also applied to the Chemical Abstract Services (CAS) for assignment of a CAS Index name and number. The Client successfully obtained the LVEs from the EPA.

Odor Evaluation

Dr. Vetrano manages TRC's Olfactory Laboratory and serves as the panel moderator for TRC's volunteer sensory panel for evaluation of odorous emissions from a number of sources including manufacturing facilities, wastewater treatment and sludge composting facilities, waste disposal facilities, paper pulp mills and petroleum refineries. She is currently serving as Task Manager for an odor monitoring project for a local waste to energy plant. Dr. Vetrano has also conducted odor evaluation studies for the determination of dilution to threshold values for specific chemicals as well as comparative testing for odor control products.

Confidential Client, National Hog Producer, Odor Monitoring – MO (Project Manager: 2007-Present)
Dr. Vetrano serves as Project manager for the largest on-going odor monitoring project in the United States. The Project is staffed by over 40 trained odor monitors, who conduct ambient odor monitoring at fixed locations in support of the client in litigation proceedings. Odor readings are conducted every 15 minutes over daily odor monitoring periods using the Nasal Ranger™. The data has been used to successfully defend the client in a lawsuit regarding hog odors.

Confidential Client, Waste to Energy Plant, Odor Monitoring – CT (Task Manager: 1999-Present)
Dr. Vetrano serves as Task Manager for the maintenance of a 24-hour odor complaint hotline. As part of this task, Dr. Vetrano coordinates the hotline response team as well as responds to odor complaint calls from local citizens and deals with facility personnel. Additionally, Dr. Vetrano coordinated and served on the weekend odor monitoring team. TRC provided necessary trained personnel support intensive odor monitoring on weekend nights. The odor monitoring patrol followed a previously identified route map that was continually monitored during the course of each shift. The route was known to include locations of odor detection previously identified to the client during TRC's ongoing support of the odor complaint hotline and included towns and specific neighborhoods surrounding the facility. In addition to these locations, other odor sources were monitored during the course of the patrol shift.

Confidential Client, Waste Water Treatment Plant, Odorous Emissions Testing – Hartford, CT (Project Manager: 2000-Present)
Dr. Vetrano performs odor threshold studies on a municipal wastewater treatment plant. The program evaluates the significant sources of odor to determine potential contributions to local community odor levels. She conducts odor evaluations to evaluate the efficacy of online odor control systems.

Confidential Client, Waste Water Treatment Plants, Odorous Emissions Testing – Various (Project Manager: Present)
Dr. Vetrano performs odor threshold studies on municipal wastewater treatment plant facilities. Programs evaluate the significant sources of odor to determine potential contributions to local community odor levels. In some cases, emissions were known to contain reduced sulfur compounds, volatile organic compounds, semivolatile organic compounds, and ammonia. In some cases, a toxicological evaluation was conducted to assess the potential adverse effects to the odor panelists. Compound concentrations were compared to known standards (ceiling limits) and samples were diluted to yield concentrations below the ceiling limits, if appropriate.

Confidential Client, Engineering Firms, Odorous Emissions Testing – Various (Project Manager: Present)
Dr. Vetrano performs odor threshold studies for various environmental engineering firms. Samples are collected and sent to TRC's Olfactory Laboratory for odor evaluation.

Confidential Client, Specialty Chemical Company, Determination of Odor Thresholds – Belle, WV (Project Manager: 2006-Present)
Dr. Vetrano is designing odor threshold determination studies for Phenylacetic acid to be used as part of the health and safety plan of the manufacturer. Odor values to be used in industrial hygiene practices for potential early warning properties. She is working with analytical lab to overcome analytical challenges.

Confidential Client, Consumer Product Manufacturer, Odorous Emissions Testing – Jacksonville, IL (Project Manager: 2006)
Dr. Vetrano performed odor threshold studies on emissions from a consumer product manufacturer. She managed personnel in the conduct of neighborhood odor surveys and conduct of odor monitoring to assist facility in identification and source of odors and mapping of odorous events in the surrounding community.

Confidential Client, Municipal Landfill, Odorous Emissions Testing – MA (Project Manager: 2005-2006)
Dr. Vetrano performed community odor surveys in neighboring areas surrounding the municipal landfill, following complaints by the town. She conducted surveys and mapped areas of odor in the neighborhood.

Confidential Client, Paper Manufacturer, Odorous Emissions Testing – CT (Project Manager: 2002)
Dr. Vetrano performed odor threshold studies on emissions from a paper manufacturing facility. Programs evaluated the significant sources of odor to determine potential contributions to local community odor levels and evaluate the efficacy of online odor control systems.

Confidential Client, Corn Processing Facility, Odorous Emissions Testing – IL and Brazil (Task Manager: 1993-1994)
Dr. Vetrano performed odor threshold studies on emissions from various aspects of corn processing. The results from the two facilities will be compared and used to design emission control technologies for the Illinois plant.

Confidential Client, Medical Clinic, Anesthesiology Department, Determination of Odor Thresholds – Rochester, MN (Project Manager: 2001)
Dr. Vetrano conducted odor and recognition threshold studies on the common gaseous anesthetic, isoflurane. Due to the nature of the anesthetic, concentrations can build up in the operating suite as a result of off-gassing from a patient's exhalations. Odor values to be used in industrial hygiene practices for potential early warning properties.

American Petroleum Institute, Determination of Odor Thresholds – Washington, DC (Project Manager: 1993)
Dr. Vetrano conducted odor and taste threshold studies on the gasoline oxygenate tertiary amyl methyl ether (TAME) for the American Petroleum Institute (API). She conducted the project and served as the panel moderator for TRC's volunteer sensory evaluation panel. Dr. Vetrano performed an evaluation on aerosolized and aqueous samples to determine air and water odor detection and recognition threshold values. She conducted a taste test on the aqueous samples for the determination of an aqueous taste threshold. These studies focused on gasoline oxygenates mandated by the Clean Air Act Amendments and led to the design of odor threshold studies on oxygenated fuels.

American Petroleum Institute, Determination of Odor Thresholds – Washington, D.C. (Project Manager: 1994)
Dr. Vetrano conducted odor threshold studies for API to examine the effect of oxygenate addition on the odor of gasoline blends. Three blends of gasoline were evaluated for their odor detection and recognition in air. The gasolines were then combined with the gasoline oxygenates MTBE, ETBE and TAME to evaluate the effect of the oxygenates on the gasolines' odor detection and recognition thresholds (API Publication No. 4592, January, 1994).

Confidential Client, Chemical/Petroleum Corporation, Determination of Odor Thresholds – PA (Project Manager: 1993)
Dr. Vetrano performed odor and taste threshold studies on gasoline oxygenates for a major petrochemical company. She conducted the project and was the panel moderator for TRC's volunteer sensory evaluation panel. She performed

an odor evaluation on aerosolized and aqueous samples to determine air and water odor detection and recognition threshold values. Dr. Vetrano conducted a taste test on the aqueous samples for the determination of an aqueous taste threshold. These studies focused on a gasoline oxygenate mandated by the Clean Air Act Amendments, as well as possible substitutes for this oxygenate. These studies led to the design of comparative odor threshold studies on oxygenated fuels from the "lower 48" states and Alaska. She also conducted studies, in conjunction with the University of Alaska, on the effect of cold on the odor thresholds of oxygenated "lower 48" and Alaskan fuels.

Confidential Client, Specialty Chemical Firm, Determination of Odor Thresholds – CT (Project Manager: 1994)
Dr. Vetrano developed odor detection and recognition threshold values for various chemicals to be used as part of the health and safety plan of the manufacturer. Odor values used in industrial hygiene practices for potential early warning properties.

Confidential Client, Chemical/Petroleum Corporation, Determination of Odor Thresholds – TX (Project Manager: 1993)
Dr. Vetrano performed odor threshold studies on gasoline additives for a major petrochemical company. She performed comparative odor threshold studies on gasoline with and without the additives, to determine at which concentrations of the additives the odor of gasoline would be changed.

Comparative Product Testing

Confidential Client, Consumer Product Manufacturers, Comparative Product Testing – Various (Project Manager: 1994-1996)
Dr. Vetrano designed and performed comparative odor evaluation studies to evaluate the efficacy of consumer odor control product versus competing brands. Products evaluated included carpet fresheners, underarm deodorants, foot powders and cat litter. She provided litigation support for false advertising claims made by competitors.

Indoor Air Quality Investigations

Dr. Vetrano manages and conducts indoor air quality (IAQ) investigations of commercial and institutional buildings. IAQ surveys typically identify potential sources of indoor air pollutants, survey occupant health status, evaluate air handling system(s), and determine the types and levels of chemicals present in the indoor environment. Typical IAQ surveys include sampling for carbon dioxide, carbon monoxide, temperature and relative humidity, total dust, volatile organic chemicals, formaldehyde and mold/spores.

Confidential Client, Consumer Product Manufacturer, Industrial Hygiene Program Review – Stamford, CT (Project Manager and Toxicologist: 2001-Present)
Dr. Vetrano is currently serving as Project Manager for the review and revision of the industrial hygiene program for a major consumer product manufacturer. She provided toxicological expertise in evaluating raw materials for toxicity to workers to aid in the design of a personal protection equipment program.

SPECIALIZED TRAINING

- ITRC Vapor Intrusion Pathway: A Practical Guideline. 2-Day Classroom Training. Oklahoma City, Oklahoma. April 6 – April 7, 2009.
- Dose-Response Modeling for Occupational and Environmental Risk Assessment. Continuing Education Course. Society of Toxicology Annual Meeting. Seattle, WA. March 2008.
- Nanotoxicology: The Science of Developing a Safe Technology. Continuing Education Course. Society of Toxicology Annual Meeting. Seattle, WA. March 2008.
- Vapor Intrusion Attenuation Workshop - A Study of Observed Vapor Intrusion Attenuation. 14th Annual West Coast Conference on Soils, Sediments and Water, Marriott Mission Valley, San Diego, California. March 15-18, 2004
- Risk Assessment for Metals. Continuing Education Course. Society of Toxicology Annual Meeting, San Francisco, CA, March 2001
- Mid-America Toxicology Course. Kansas City, Missouri, May 2000
- Practical Issues in the Use of Probabilistic Risk Assessment. EPA and the University of Florida, Tampa, FL, April 2000
- OSHA 40-Hour HAZWOPER Training (29 CFR 1910.120)
- MSDS: Preparing for the Next Wave of Hazard Communication Requirements. Annapolis, MD, Nov. 9-10, 1998
- Overview of Uncertainty Analysis. Continuing Education Course. Society of Toxicology Annual Meeting, Seattle, WA, March 1998
- Risk Communication: Making Risk Management More Effective. Continuing Education Course. Society of Risk Analysis Annual Meeting, New Orleans, LA, December 1996
- International Harmonization: Update on Scientific and Regulatory Issues. Part II: Toxic Substances and Environmental Issues. Continuing Education Course. Society of Toxicology Annual Meeting, Dallas, Texas, March 1994
- Toxicokinetics: Study Design and Data Analysis. Continuing Education Course. Society of Toxicology Annual Meeting, Dallas, Texas, March 1994
- Risk: Science, Assessment and Management Mini-Course, Conducted by the Office of Continuing Education and the Center for Risk Analysis, Harvard School of Public Health, Boston, MA, 1993
- Risk Communication: Problems, Perceptions and Practice. Continuing Education Course. Society of Toxicology Annual Meeting, Dallas, Texas, February 1991

- Environmental Toxicology. Continuing Education Course. Society of Toxicology Annual Meeting, Dallas, Texas, February 1991.

PROFESSIONAL AFFILIATIONS

- Society of Toxicology
- Northeast Chapter of the Society of Toxicology, past Councilor, 1997-1999
- Society for Risk Analysis, New England Chapter, Secretary, 2000 - present
- Society for Risk Analysis

SELECTED PUBLICATIONS

Vetrano, K.M., "Molecular Chlorine: Health and Environmental Effects," *Reviews of Environmental Contamination and Toxicology*, 170:75-139, 2001.

Vetrano, K.M., "Pamphlet 90: Molecular Chlorine: Health and Environmental Effects," Prepared for the *Chlorine Institute,* Edition 2, November 1998.

Vetrano, K.M., "Odor Threshold Studies Performed with Gasoline and Gasoline-Combined with MTBE, ETBE, and TAME," Prepared for the *American Petroleum Institute*, Publication No. 84145920, 1994.

Vetrano, K.M., Morris, J.B. and Hubbard, A.K., "Silica Induced Inflammation and Fibrosis in Mice is Altered by Acute Exposure to Nitrogen Dioxide," *Journal of Toxicology and Environmental Health* 37:389406, 1992.

Vetrano, K.M., "The Modulation of Silica-Induced Pulmonary Inflammation and Fibrosis by Acute Nitrogen Dioxide Exposure in the C57Bl/6 Mouse," *University of Connecticut,* 1992.

Vetrano, K.M., and Hubbard, A.K., "The Modulation of Silica Induced Pulmonary Inflammation by Acute Exposure to Nitrogen Dioxide," *The Toxicologist,* 11:337, 1991.

Ginsberg, G.L., Hauchman, F.S., Vetrano, K.M., Bement, C.L., and Koch, W.H., "The Feasibility of Route-to-Route Extrapolation (RRE) of Cancer Potency Factors for Aniline, Dioxane, Isophorone and Benzyl Chloride," *The Toxicologist,* 11:903, 1991.

Wooten, V., Brown, D.R., Callahan, B., Vetrano, K.M., Schatz, R.A., Melia, J. and Mulligan, T., "Behavioral and Biochemical Alterations Following in Utero Exposure to Methylmercury," *Neurobehavioral Toxicology and Teratology*, 7(6): 767773, Nov. Dec. 1985.

SELECTED PRESENTATIONS

Vetrano, K.M., "Crystalline Silica Exposure Assessments," *Sorptives Mineral Institute's Annual Meeting*, May 1997.

Vetrano, K.M., "Odorous Emissions and Their Relationship to Human Health," New *England Society for Risk Analysis*, Boston, MA, September 1993.

Vetrano, K.M., "Odor Thresholds in Relation to Risk Assessment," *New England Section and Connecticut Chapter Air and Waste Management Association*, Hartford, CT, October 1993.

Ginsberg, G.L., Koch, W.H., Vetrano, K.M., Bement, C.L. and Hauchman, F., "Factors That Govern the Feasibility of Dose Route Extrapolation: An Analysis of 10 Clean Air Act Carcinogens," *Society for Risk Analysis*, Baltimore, MD, December 1991.

Vetrano, K.M., and Hubbard, A.K., "The Modulation of Silica Induced Pulmonary Inflammation by Acute Exposure to Nitrogen Dioxide," *Society of Toxicology Annual Meeting*, Dallas, TX, February 1991.

Ginsberg, G.L., Hauchman, F.S., Vetrano, K.M., Bement, C.L., and Koch, W.H., "The Feasibility of Route-to-Route Extrapolation (RRE) of Cancer Potency Factors For Aniline, Dioxane, Isophorone and Benzyl Chloride," *Society of Toxicology Annual Meeting*, Dallas, TX, February 1991.

Vetrano, K.M. and Hubbard, A.K., "Pulmonary Inflammatory Response of C57Bl/6 BG/BG (beige) Mice to Instilled Glass Fibers or Silica Crystals," *World Conference on Lung Health*, Boston, MA, May 1990. Also presented at the *Northeast Chapter of the Society of Toxicology Meeting*, Weston, MA, June 1990.

Hubbard, A.K., Lombard, K.M., Pokhrel, P.K. and Vetrano, K.M., "Mechanisms Underlying Outcome of Particle Induced Pulmonary Inflammation," *Connecticut Lung Research Conference*, Southbury, CT, April 1990.

Vetrano, K.M., Reece, K.D., Brown, D.R. and Smith, L.W., "An Industrial Example of a Health Hazard Determination Procedure," *Northeast Chapter of the Society of Toxicology/ Autogenesis Association of New England Joint Meeting*, Storrs, CT, October 1985.

Wooten, V., Brown, D.R., Callahan, B., Vetrano, K.M., Schatz, R.A., Melia, J. and Mulligan, T., "Behavioral and Biochemical Alterations Following in Utero Exposure to Methylmercury," *The Symposium and Workshop Design Considerations in Screening for Behavioral Teratogens*, Cincinnati, OH, September 1985.

TRC

SCOTT J. HEIM

EDUCATION

M.S., Wildlife Ecology, University of New Hampshire, 1988
B.S., Forest Biology, State University of New York - College of Environmental Science and Forestry, 1982
A.A.S., Pre-Professional Forestry, Paul Smith's College, 1979

PROFESSIONAL CERTIFICATIONS

Certified Associate Wildlife Biologist, The Wildlife Society, 1988
Certified – Principles and Techniques of Electrofishing, USFWS, 2002

AREAS OF EXPERTISE

Mr. Scott J. Heim has more than 26 years of experience encompassing:

- Ecological Risk Assessment
- Wetland Delineation, Functional Analysis, and Construction
- Aquatic/Terrestrial Ecology
- Rare Species Surveys and Impact Assessment
- Natural Resource Damage Assessment
- Environmental Permitting
- Environmental Assessments and Impact Reports

REPRESENTATIVE EXPERIENCE

Ecological Risk Assessment Experience

Mr. Heim has conducted qualitative and quantitative ecological risk assessments for both aquatic and terrestrial environments at hazardous waste sites under CERCLA and RCRA as well as state requirements (i.e., Massachusetts Contingency Plan). He has extensive experience at problem formulation at these sites by evaluating habitat characteristics of potentially contaminated areas and identifying receptor species, exposure pathways, and contaminants of ecological concern. Risk to ecological receptors has been assessed following ecological risk assessment guidance issued by the U.S. Environmental Protection Agency (USEPA) and other applicable agencies (i.e., agencies within the state where the site is located). Under an USEPA CERCLA contract, Mr. Heim has also provided third party review for ecological risk assessments submitted to USEPA.

Federal Aviation Administration Technical Center, Ecological Risk Assessment, Atlantic City International Airport – NJ
(Ecological Risk Assessor: 2002 – 2006)
Mr. Heim prepared work plans, conducted extensive biological sampling and prepared an ecological risk assessment in accordance with USEPA guidelines at the Area U Superfund Site which consists of a wetlands complex containing two large reservoirs, two perennial streams and extensive floodplain wetlands. Mr.

Heim conducted and/or managed the intensive sampling program that involved the collection of surface water, sediment, surface soil, aquatic and terrestrial macroinvertebrates, fish (large and small forage fish), phytoplankton, zooplankton, frogs, small mammals, bird eggs and bats as well as quality assurance/quality control procedures. The risk assessment investigated mercury impacts through the food chain. Mr. Heim prepared the ecological risk assessment for submittal to federal and state agencies for their review. The assessment focused on identifying risks through a weight-of-evidence approach as well as defining the ecological values provided by the habitats contained within Area U so that a balanced approach could be undertaken in the risk management process to evaluate remediation options.

Seaholm Power Plant and Substation, Ecological Risk Assessment – Austin, TX (Ecological Risk Assessor: 2002 – 2003)
Previous sampling had detected elevated concentrations of polychlorinated biphenyls (PCBs) within sediments of Shoal Creek, a perennial stream adjacent to an existing electric generating facility and substation. Mr. Heim prepared a Sampling and Analysis Plan (SAP) for performing a Tier 2 Screening-Level Ecological Risk Assessment in accordance with the Texas Risk Reduction Program and Risk Reduction Rule. The SAP presented an approach for assessing ecological risk within Shoal Creek and focused primarily on upper trophic level receptors that may be affected through biomagnification of PCBs within the food chain. The SAP was approved by the Texas Natural Resource Conservation Commission. Field sampling and laboratory analyses showed that PCB concentrations within the sediments did not pose an ecological risk.

Shieldalloy Metallurgical Corporation, Ecological Risk Assessment – Newfields, NJ (Ecological Risk Assessor: 1995 – 2006)
Mr. Heim conducted an ecological risk assessment for a facility that discharged metals into an adjacent stream, pond, and wetlands. Mr. Heim prepared a sampling strategy and collected sediment samples for chemical and laboratory toxicity testing as well as conducted a macroinvertebrate bioassessment. Aquatic hazards were characterized by Mr. Heim using the Triad approach (sediment chemistry, laboratory toxicity tests, and macroinvertebrate community assessment). Risks to food chain also evaluated by identifying receptor species, exposure pathways, and modeling exposure doses of contaminants to selected indicator species. Potential risks from metal contamination identified for piscivorous species and aquatic macroinvertebrates. Results of the risk assessment were used to determine areas requiring remediation.

Phosphate Mine, Ecological Risk Assessment – Southeastern ID (Ecological Risk Assessor: 1998 – 2006)
Mr. Heim conducted a comprehensive baseline ecological risk assessment for a former phosphate mine located near the Blackfoot River in southeast Idaho. Tailings from the mining operation resulted in the leaching of selenium into surface waters of a nearby stream. Significant riparian and upland habitats of the

study area were characterized and aquatic and terrestrial species that inhabit these areas identified. Representative indicator species were selected and sampling conducted of various components of their diets (i.e., vegetation, invertebrates, small mammals) to determine potential exposure. Risk to the aquatic environment was evaluated through the comparison of selenium (including selenate and selenite) concentrations with available criteria and interpreting the results of macroinvertebrate community sampling. The results of tissue bioassays were used to assess risk to the selected wildlife indicator species by modeling exposure doses of selenium. The risk assessment results indicate that there are potentially significant risks to avian receptors based on exposure to selenium detected in biota, surface soils and sediments within the study area. The results of the risk assessment including preliminary remediation goals were used by the client to develop potential remedial solutions at the site.

Phoenix-Goodyear Airport Superfund Site, Ecological Risk Assessment – Maricopa County, AZ (Ecological Risk Assessor: 2007 - 2008)
Mr. Heim characterized ecological risks associated with exposure to cadmium and chromium where previous industrial operations resulted in contamination of surface and subsurface soils at five terrestrial areas. Mr. Heim conducted a site inspection to identify and characterize habitats, potential ecological receptors and complete exposure pathways. A screening–level ecological risk assessment (SLERA) was subsequently prepared by Mr. Heim using an innovative approach to assess risk to a variety of receptor groups though incorporation of ecological soil screening levels (eco-SSLs) and site-specific factors. The SLERA concluded that none of the areas investigated were likely to provide a significant risk to ecological receptors. Both the U.S. Environmental Protection Agency and Arizona Department of Environmental Management concurred with the findings of the SLERA.

Refinery Site, Ecological Risk Assessment – Casper, WY (Ecological Risk Assessor: 1995 – 1998)
Mr. Heim characterized ecological risks associated with exposure to contaminants at a former refinery where the industrial operations resulted in contamination of surface soils and wetland sediments. The adjacent North Platte River was also potentially impacted by petroleum hydrocarbons and lead. Risk to aquatic receptors was characterized by interpreting results of macrobenthic invertebrate sampling, toxicity testing and comparing chemical concentrations in surface water and sediments to criteria, guidelines, or toxicity-based benchmark values. In order to assess terrestrial risk from metals and petroleum hydrocarbons, small mammals were collected and analyzed. Mr. Heim estimated contaminant doses to wetland and terrestrial indicator species by modeling exposure from the ingestion of small mammals, plants, and invertebrates. The risk assessment determined that animals foraging in limited portions of the site may potentially be affected by the metal contamination detected in surface soils while petroleum hydrocarbons present in seepage areas adjacent to the river pose an environmental risk to receptor species present in these areas. The

quantitative ecological risk assessment supported the client's decision to remediate discrete areas of contamination.

Homestake Mining Company, Ecological Risk Evaluation – CA
(Ecological Risk Assessor: 2000 – 2001)
Mr. Heim conducted a post-closure ecological review for the McLaughlin Mine site in northern California. The ecological review evaluated risks to wildlife receptors that may utilize the habitats provided by the existing mine pits and a tailings pond. Data evaluated in the risk assessment included surface water sampling results (total and dissolved concentrations) as well as vegetation sampling results collected from a pilot test study conducted within the tailings pond. The risk assessment focuses on wildlife receptors documented at the site or likely to use the aquatic habitats at the site following closure of the mine. Indicator species were selected to estimate potential risk from surface water ingestion and consumption of vegetation or aquatic insects. Daily ingestion doses of metal contaminants were calculated for the indicator species and compared to reference toxicity values for metal contaminants.

Reynolds Metal, Ecological Risk Assessment – Massena, NY
(Ecological Risk Assessor: 1992)
Under an USEPA contract, Mr. Heim conducted a comprehensive baseline ecological risk assessment for an aluminum manufacturing facility (Superfund Site) situated between the St. Lawrence and Raquette rivers in upstate New York. Significant riverine, riparian, and wetland habitats of the Reynolds study area were characterized and aquatic and terrestrial species that inhabit these areas identified. Risk to the aquatic environment was evaluated through the comparison of contaminants of concern concentrations with available criteria and interpreting the results of macroinvertebrate community sampling. The results of target fish species bioassays were used to assess risk to piscivorous wildlife species by modeling exposure doses of PCBs to the selected indicator species. The risk assessment determined that there were significant risks to ecological receptors based on exposure to contaminants detected in sediments and fish within the St. Lawrence River. The results of the risk assessment were used by USEPA to support remedial decisions at the site that included sediment cleanup to prevent direct contact with fish and uptake of PCB-contaminated sediments.

Former Tie Treating Plant, Ecological Risk Assessment – Albuquerque, NM
(Ecological Risk Assessor: 2000 – 2001)
A former railroad tie treating plant resulted in contamination of surface soils at the Superfund site. Mr. Heim reviewed a screening ecological risk assessment prepared by the New Mexico Environment Department. Based on this review, revisions to the risk assessment were undertaken, contaminants of potential concern were selected and additional sampling proposed to reduce uncertainties in the screening assessment. Mr. Heim prepared a sampling plan to address bioaccumulation of polycyclic aromatic hydrocarbons (PAHs), dioxin and metals within plant, invertebrate, and small mammal tissues. The results of the sampling

program were incorporated into the ecological risk assessment prepared by Mr. Heim as part of the Remedial Investigation.

Massachusetts Military Reservation, Third Party Review – MA
(Ecological Risk Assessor: 1992 – 1998)
Under an USEPA contract, Mr. Heim provided expert technical oversight for ecological risk assessments conducted at the 22,000-acre Massachusetts Military Reservation (Superfund Site). More than 50 individual sites have been identified at the reservation that required ecological risk assessments to be performed. Mr. Heim provided third party review and evaluation of risk assessment methods for the USEPA for these risk assessments that included document review and attendance at meetings to support USEPA.

East Bennington Landfill, Ecological Risk Assessment – Bennington, VT
(Ecological Risk Assessor: 1994)
Mr. Heim prepared an ecological risk assessment that aided USEPA's risk management decisions to support an accelerated cleanup plan for the site. Identified sensitive environments and potential ecological receptors at the site and within the vicinity. Environmental sampling data from the surface water, sediment, and surface soil were evaluated and ecological contaminants of concern and potential exposure pathways identified. Risks to aquatic biota were evaluated through a comparison of surface water and sediment contaminant concentrations with applicable criteria/guidelines for aquatic life and interpreting the results of macrobenthic invertebrate sampling. Exposure doses to several semi-aquatic and terrestrial indicator species were modeled and compared with benchmark toxicity values. Hazards to upper trophic level species from PCB biomagnification were also modeled and evaluated. Risks to aquatic, semi-aquatic, and terrestrial species were greatest from the detected concentrations of PCBs within selected habitats at the landfill site. Remedial activities proposed at the site would result in alteration of wetlands. Proposed mitigation and monitoring programs for wetlands restoration/creation were reviewed and recommendations provided to USEPA

Revere Textiles Mill, Ecological Risk Assessment – Sterling, CT
(Ecological Risk Assessor: 1992)
Under an USEPA contract, Mr. Heim characterized ecological risk to the aquatic environment at a Superfund Site using several methods (equilibrium partitioning approach and results of sediment toxicity testing for two macroinvertebrates). Terrestrial risk evaluations involved the development of food chain models to estimate exposure doses. Estimated doses were compared to reference toxicity values to determine the risk to selected terrestrial indicator species. Results of the risk assessment were used by USEPA to remove the site from the list of active NPL sites.

Ecological Risk Evaluation – Honolulu Harbor, Honolulu, HI
(Ecological Risk Assessor: 2003)
A quantitative Screening Level Ecological Risk Evaluation (SCLERE) was conducted of the ecological impacts within Honolulu Harbor from the discharge of groundwater containing petroleum-related constituents of potential concern that are associated with various industrial facilities located adjacent to the harbor. A Site Conceptual Model was prepared that identified exposure pathways, potential receptors and fate and transport mechanisms. Risk was evaluated by comparing applicable ambient water quality criteria with the concentrations of groundwater constituents of potential concern. Fate and transport mechanisms that affect the concentrations of groundwater constituents of potential concern were also considered in the SCLERE. The results of the SCLERE demonstrated that the discharge of groundwater into the harbor does not pose an unacceptable risk to aquatic organisms inhabiting the harbor.

Former GE Site, North Reading, Environmental Risk Characterization – MA
(Ecological Risk Assessor: 2001 – 2003)
A Stage II Environmental Risk Characterization (ERC) was conducted by Mr. Heim under the Massachusetts Contingency Plan (MCP) for a large wetland area associated with two outfall discharge structures at a former industrial facility. A Scope of Work was prepared and submitted to the Massachusetts Department of Environmental Protection that proposed sampling of surface water, sediment, surface soil, vegetation and invertebrates for metal contaminants of concern that were associated with the two outfalls. In addition, earthworm toxicity testing was also conducted on wetland surface soils. Habitats, potential receptor species, and exposure pathways were identified by Mr. Heim during a site reconnaissance. Mr. Heim collected the samples and prepared the Stage II ERC. The Stage II ERC concluded that the vegetation and invertebrate community as well as mammalian insectivores within a limited area of the wetlands may be impacted by metal contamination (primarily copper and zinc). Limited remediation and wetlands restoration was subsequently proposed for addressing the metals contamination within the wetland.

Wetlands Experience

Mr. Heim has delineated wetlands on hundreds of sites located throughout the eastern United States ranging from less than one-half acre to more than 1,200 acres in size. Wetlands have typically been identified and delineated according to procedures established within the U.S. Army Corps of Engineers Wetland Delineation Manual (1987). Mr. Heim also has extensive experience with various state and local wetland definitions. Mr. Heim has also reviewed wetlands delineations conducted by other consultants and assessed impacts to wetlands from proposed development activities. Mr. Heim also performed numerous wetland functional analyses utilizing the Wetland Evaluation Technique (WET 2.0) developed by the U.S. Army Corps of Engineers and other accepted methodologies and has designed wetland restoration/ creation areas and

supervised actual construction efforts. Mr. Heim also has extensive experience with permitting projects through applicable wetland regulations.

Armenia Mountain Wind Energy Project – PA (Ecologist: 2007-2008)
A 186 MW wind energy farm was proposed within 11,000 acres of leased land located in northcentral Pennsylvania. Mr. Heim oversaw the delineation of wetland/stream resource areas located in the vicinity of the proposed wind turbine structures and their access roads as well as the proposed electrical transmission facilities. Mr. Heim prepared a Jurisdictional Determination (JD) report that was submitted, reviewed in the field, and approved by the U.S. Army Corps of Engineers (USACE). A detailed wetlands permit application was prepared by Mr. Heim and submitted to the USACE and the Pennsylvania Department of Environmental Protection (PADEP). The permit application discussed the 40 wetland/stream impact areas, a detailed alternative analysis, and appropriate mitigation for the unavoidable wetland impacts. An administratively complete letter was received from PADEP one day after the permit application submittal. The wetlands permit and authorization were subsequently obtained from the PADEP and USACE.

Lawrence Energy Center, Wetland Delineation – OH (Ecologist: 2000 – 2001)
A power generating facility was proposed at a 280 acre site located in Lawrence County in southeastern Ohio that contained significant areas of wetland (and prior converted croplands) adjacent to the Ohio River. Mr. Heim delineated and characterized wetland resources (including a functional assessment) present on the entire site and prepared a Jurisdictional Determination (JD) report that was submitted and approved by the U.S. Army Corps of Engineers.

Rochester Gas and Electric, Rochester Transmission 115 kV Project – NY (Ecologist: 2003)
Mr. Heim was tasked with identifying wetlands and terrestrial ecological habitats and authoring pertinent sections for the preparation of an Article VII application for 115 kV system reinforcements in Monroe and Wayne Counties, New York. The proposed route assessed by Mr. Heim included approximately 19 miles of rebuilt overhead 115 kV transmission lines as well as a new 115 kV substation. The Article VII application was prepared on a fast-track basis and filed approximately 12 weeks following Notice to Proceed. The Article VII Certificate was subsequently issued following negotiation of a Joint Proposal without adjudicatory hearings.

AES Red Oak – Sayreville, NJ (Ecologist: 1998 – 1999)
A power generating facility was proposed at a 63-acre site located in east-central New Jersey that contained significant areas of wetland. Mr. Heim delineated and characterized the wetlands on the site and subsequently filed a Letter of Interpretation (LOI) with the New Jersey Department of Environmental Protection (NJDEP) to confirm the wetlands boundary. After the wetlands delineation was

accepted by NJDEP, Mr. Heim assisted in obtaining wetland-related permits for the proposed project. In order to address concerns by the U.S. Fish and Wildlife Service (USFWS) regarding the potential presence of *Helonias bullata*, a threatened plant species, Mr. Heim conducted a quantitative vegetative survey of the parcel for the rare plant and potentially suitable habitat. The survey report and findings were submitted and subsequently approved by the USFWS.

KC Realty Trust, Wetland Restoration – Newburyport, MA (Ecologist: 1999 – 2003)
Mr. Heim prepared a wetland restoration plan for a 2.6 acre palustrine emergent wetland area located within an industrial park in Newburyport, Massachusetts. The design included preparing a plan that specified excavation depths, volume of material to be removed, a planting plan, and a post-construction monitoring protocol. The restoration plan was submitted to the U.S. Army Corps of Engineers, MA Department of Environmental Protection, and the Newburyport Conservation Commission for their approval. Mr. Heim oversaw the construction and seeding of the wetland restoration area and has conducted two years of post-construction monitoring. The monitoring has documented the successful restoration of the wetland in conformance with applicable performance standards and the approved restoration design.

U.S. Generating Company – CT (Ecologist: 1998)
The siting of co-generation power plant facilities was being considered at three locations in Connecticut. Site inspections were undertaken and the presence and approximate locations of wetland resource areas (based on State of Connecticut and U.S. Army Corps of Engineers wetland definitions) determined at each of the three sites. Wetland permitting issues were evaluated as part of a Critical Flaw Analysis conducted for each of the three sites. The analysis concluded that wetlands permitting would be a major issue associated with the siting of one proposed facility while wetlands permitting at the remaining two proposed sites would not be expected to result in significant issues. This information was used by the client in prioritizing sites for proposed development.

SCS, Inc. Astoria – NY(Ecologist: 1999 – 2000)
A power generating facility was proposed on a parcel of land located adjacent to the East River and Steinway Creek in New York City. Identified the wetland resource areas in the vicinity of the project site under the jurisdiction of the U.S. Army Corps of Engineers and/or New York State Department of Environmental Conservation. The project included a proposed electric transmission line interconnect over a portion of Steinway Creek (a tidal wetland resource area). Provided input to the interconnect design to ensure that the proposed crossing was conducted in accordance with all federal and state requirements. Potential impacts to a state-listed endangered bird species were also evaluated and discussed in the subsequent Article X application to the New York State Department of Public Service.

Shady Lane Landfill – Nashua, NH (Ecologist: 1995)
The City of Nashua as well as the general public was extremely concerned about the health risks associated with a former landfill located in close proximity to an existing elementary school. The landfill required final closure (i.e., capping) within a critical time schedule in order to allow the elementary school to reopen in time for the fast-approaching fall school year. The landfill is also immediately adjacent to Salmon Brook and associated wetlands - sensitive areas designated as "Prime Wetlands" by the State of New Hampshire and City of Nashua. Wetlands located within and adjacent to the landfill were identified and delineated by TRC using the wetland definition provided in the 1989 Federal Interagency Wetlands Delineation Manual. An assessment of wetland impacts from the proposed landfill closure was conducted by TRC and appropriate mitigation proposed within the permit application. TRC requested a pre-application meeting with the Nashua Conservation Commission to present the proposed closure plan and address concerns of the Commission. Support from the Nashua Conservation Commission was subsequently critical in TRC's public hearing before the State of New Hampshire Wetlands Board. TRC successfully obtained a permit from the Wetlands Board (and the Nashua Zoning Board of Appeals) within the minimum time frame allowing the landfill closure to proceed. In addition, TRC confirmed that the closure plan was acceptable to the U.S. Army Corps of Engineers as a general nationwide permit under Section 404 of the Clean Water Act. The landfill closure was subsequently initiated on schedule and the City of Nashua was able to successfully reopen the elementary school in time for fall classes. In addition, the City of Nashua benefited by the timely landfill closure as water quality was substantially improved within the adjacent "Prime Wetlands".

U.S. Post Office Facility – Stonington, CT (Ecologist: 1997 – 1998)
The limits of wetlands and presence of important features (pertaining to the natural environment) on the proposed site and two alternative sites for a new postal facility were identified by TRC. In addition, Mr. Heim evaluated the type of wetlands present on the sites (using the U.S. Fish and Wildlife Service classification method), evaluated impacts to the wetland from the proposed facility, and provided recommendations to mitigate unavoidable wetland impacts. The functions and values of the wetland (using the "Descriptive Approach" proposed by the New England Division of the U.S. Army Corps of Engineers) were also evaluated and the principal function(s)/value(s) identified. Lists of identified plant and wildlife species that may potentially use the wetland were provided by Mr. Heim. The wetland assessment included an analysis for the six types of impacts that are specified in the U.S. Postal Service protocol (Facilities Environmental Guide Handbook RE-6, December, 1997). Information concerning the presence of rare/endangered species on the site and the required federal permit(s) needed for placement of fill within the wetland were also provided by Mr. Heim. The report was used by the U.S. Postal Service in justifying their selection of the site for the new postal facility.

Reliant Energy – Conneaut Township, PA (Ecologist: 1999 – 2000)
A power generating facility was proposed on an 80-acre parcel of land located in northwestern Pennsylvania. Delineated and characterized the wetlands located on the parcel and prepared a Jurisdictional Determination report that was submitted to the U.S. Army Corps of Engineers (ACOE) and Pennsylvania Department of Environmental Protection (PADEP). The ACOE and PADEP conducted a joint site inspection and issued a JD that confirmed the wetlands delineation. An investigation was also conducted that evaluated the potential of the site wetlands to function as vernal pools and provide important amphibian breeding areas.

Toll Brothers, Inc. – Walpole, MA (Ecologist: 1995 – 1999)
Wetlands present within a 180-acre parcel of land where a controversial residential subdivision was proposed were delineated based on definitions provided in the Massachusetts Wetlands Protection Act and 1987 U.S. Army Corps of Engineers (ACOE) Wetland Delineation Manual. TRC prepared a Request for Determination of Applicability (RFDA) and Notice of Intent (NOI) under the Massachusetts Wetlands Protection Act and the Town of Walpole Wetlands Bylaw and represented the client at public hearings and site inspections. The project was successfully permitted through the Walpole Conservation Commission. Applications for Section 404 and Section 401 (Water Quality Certification) were prepared and submitted to the ACOE and Massachusetts Department of Environmental Protection, respectfully.

Mirant 750MW Bowline Generating Station – Haverstraw, NY (Ecologist: 1999 –2001)
Mr. Heim was responsible for surveying and identifying wetlands and terrestrial plant communities on the Mirant Bowline Point facility located in Haverstraw, NY. The intent of the surveys was to identify wetland resource areas, characterize plant communities on the site and make assessments regarding the effects of disturbance on the compositional and structural attributes of the identified communities. This work was conducted in accordance with the requirements of an Article X application relative to the construction and operation of a 750 MW combined cycle combustion turbine electric generating plant. Mr. Heim also presented expert testimony at an adjudicatory hearing regarding identification and impacts associated with wetlands and terrestrial plant communities at the site. The Article X Certificate was issued in 2002. Mr. Heim also prepared a wetlands mitigation plan and supervised the construction of a 1.2 acre mitigation area to compensate for wetlands impacted by the project. The mitigation plan was subsequently approved by the U.S. Army Corps of Engineers and Mr. Heim has initiated monitoring of the constructed wetland.

Loral Microwave Frequency, Inc. – Chelmsford, MA (Ecologist: 1994)
A wetlands delineation was conducted on a 14-acre parcel potentially contaminated by ground water from an adjacent industrial site. In order to determine appropriate compensation, the future development potential of the 14-

acre parcel was evaluated by determining existing site development constraints (e.g., presence of wetlands). The delineation of wetlands was based on definitions presented in the Massachusetts Wetlands Protection Act regulations. A site wetlands map and report were prepared that described the site's characteristics (particularly the vegetation and soils of the site) as these features relate to wetland definitions provided in the Act. The methodology and delineation of wetland boundaries were successfully defended in an arbitration hearing to determine the appropriate level of compensation to the owner of the 14-acre parcel.

Retail Shopping Plaza – Woodbury, NY (Ecologist: 1994 – 1995)
A commercial development was proposed for a 68-acre parcel located in southeastern New York. The proposed project would result in the loss of approximately 2.3 acres of forested wetlands. Wetlands within the site were delineated based on the 1987 U.S. Army Corps of Engineers Wetland Delineation Manual. A Jurisdictional Report (JD) establishing the wetlands boundary was submitted to and approved by the Army Corps. A pre-discharge notification (PDN) was also prepared and submitted to the Corps of Engineers. The PDN evaluated the functions and values of the wetlands present on the site as well as proposed mitigation in the form of wetland replacement areas for unavoidable wetland impacts. The Army Corps granted approval for the project within several weeks of receiving the PDN. An application for state water quality certification was also prepared and approved. Mr. Heim prepared a plan for a 4.7 acre forested wetland that was proposed as mitigation. Proposed elevations, plantings and seeding specifics were included in the plan. The mitigation plan was submitted and approved by the U.S. Army Corps of Engineers (ACOE) and NY Department of Environmental Conservation. The annual monitoring program overseen by Mr. Heim was completed and the final report presenting the results of the mitigation program was accepted by the ACOE.

Pace University – Mount Pleasant, NY (Ecologist: 1993)
In order to prepare an updated Master Plan for the University, the presence of existing resource areas and their values needed to be known. Wetlands present on the entire college campus were identified and delineated by Mr. Heim using local, state, and federal wetland definitions. A rare plant survey was also undertaken on the campus to identify state-listed rare species. A wetland assessment was then conducted that evaluated the functions and values provided by each of the 11 identified wetland areas. A report was subsequently prepared by Mr. Heim that discussed characteristics of each wetland area and how these features contributed to each of the functions/values evaluated. This information was subsequently used in preparing the Master Plan for the college campus and within an Environmental Impact Report submitted for the proposed infrastructure improvements.

Paul E. Tsongas Arena, Lowell Baseball Stadium and Riverwalk – Lowell, MA (Ecologist: 1996)
Mr. Heim delineated wetland resource areas including bordering vegetated wetlands, bank, land under a waterway, bordering land subject to flooding and riverfront area for an arena, stadium and walkway proposed along the Merrimack River in Lowell, Massachusetts. Mr. Heim prepared Notices of Intent for the proposed projects that were successfully permitted through the Lowell Conservation Commission resulting in Orders of Conditions under the Massachusetts Wetlands Protection Act. The Notices of Intent addressed various wetland issues including filling within floodplain and compensatory flood storage; wildlife habitat evaluations of bank, land under a waterway, and bordering land subject to flooding; and rare species impacts associated with the adjacent Merrimack River.

New Milford Energy Project – New Milford, CT (Ecologist: 1999)
An application was submitted to the New Milford Inland Wetlands Commission for a proposed 500- megawatt natural gas-fired generating facility. Due to the complexity of the proposed project, the Commission retained TRC to assist in the review of the project and provide comments concerning potential impacts and mitigation. Mr. Heim supported the Commission by conducting a thorough review of the project's potential affects on wetlands and watercourses, providing comments to the Commission, and attended public hearings concerning the project.

Pease Air Force Base – Newington, NH (Ecologist: 1992 – 1997)
A proposed wetlands mitigation plan was reviewed and recommendations provided to EPA to increase the probability of successful wetlands creation. Site monitoring was conducted and additional measures were subsequently recommended to EPA to increase the diversity of hydrological conditions (and diversity of vegetation) at the mitigation site.

Williams Communications Inc. – New York to MA (Ecologist: 1996)
Mr. Heim performed wetland delineations and obtained environmental permits for Williams Communications, Inc. for the installation of conduits and fiber optic cable from Albany, New York to Boston, Massachusetts and from New York, New York to Boston, Massachusetts. The routes were installed in existing utility, railroad or highway rights-of way and involved crossing major waterways, state-owned properties such as state forests, and federal lands such as interstate highways controlled by the respective state departments of transportation. Because the proposed routes covered four states (Connecticut, Massachusetts, Rhode Island, and New York), the scope of this program involved review of the applicability of a number of state, local, and federal wetland determination and delineation requirements. Mr. Heim conducted field surveys to delineate federal, state and local wetland jurisdictional boundaries and used Global Positioning System (GPS) equipment to obtain the approximate coordinate location of wetlands and watercourse features.

Natural Resource Damage Assessment Experience

Mr. Heim has experience in preparing, reviewing and interfacing with regulatory agencies regarding Natural Resource Damage Assessments (NRDAs) conducted by resource trustees after the release of hazardous constituents to the environment. Mr. Heim's expertise in ecological risk assessment is utilized in evaluating the validity and/or extent of claims (including monetary damages) stated in NRDAs.

Railway Switching Yard – Clovis, NM (Ecologist: 1999)
Mr. Heim prepared a natural resource damage assessment (NRDA) for a 25-acre playa lake that had been impacted by past operations at the railway facility. The NRDA methodology used a Habitat Equivalency Analysis (HEA) that calculated past damages to the environment and determined appropriate compensation to mitigate the damages. Reviewed available information pertaining to the playa lake and assessed the value lost by the damaged natural resources by determining the area of past damaged resources, relative percent of past damages (injury factor), and relative percent of damaged resources following site remediation. The NRDA prepared was used by the client to help negotiate a settlement with the federal and state trustees. Mr. Heim also implemented an innovative approach that combined the results of the NRDA with a wetland evaluation technique to evaluate a potential settlement agreement involving a land purchase adjacent to a U.S. Fish and Wildlife Service wildlife refuge.

Industrial Client – Stockton, CA (Ecologist: 2004)
Mr. Heim reviewed a NRDA conducted by the California Department of Fish and Game for an accidental caustic discharge from the client's outfall to a water diversion canal and river. The discharge resulted in significant impacts to the fisheries resource. Mr. Heim reviewed the assumptions in the NRDA used by the Department and conducted an independent assessment using a Habitat Equivalency Analysis (HEA). The revised assessment indicated that a significant reduction in the cost assessed under the Department's NRDA could be obtained with appropriate mitigation to enhance the habitat for the fishery resource within the canal.

Insurance Client – Northeastern U.S. (Ecologist: 1995)
Mr. Heim reviewed ten Natural Resource Damage Assessments conducted at former utility properties located throughout the northeastern U.S. The NRDAs were prepared by a consultant in support of a claim filed with the insurance company for the utility. Evaluated the assessment methodology and conclusions for a variety of resources including wetlands, habitat for endangered species, fisheries and groundwater supplies. Comments were used by the insurance company in settling the claim.

Shieldalloy Metallurgical Corporation Ecological Restoration – Hudson Branch, NJ (Ecologist: 1997)
Conducted an ecological risk assessment of an adjacent stream to an active industrial site. The results of the assessment were presented to federal/state regulatory review agencies and represented the client at subsequent agency meetings. A Natural Resource Damage Assessment was subsequently conducted by the state trustee. Mr. Heim reviewed the NRDA and helped prepare a natural resource restoration plan that was acceptable to the client and the resource trustees and involved the enhancement of upland areas adjacent to the stream by re-vegetating these areas with appropriate tree and shrub species.

Aquatic Ecology Experience

Mr. Heim has conducted aquatic assessments that required collection of important water quality chemistry variables and identification of aquatic plant, macroinvertebrate and fish species. Sampling programs were designed and conducted for water chemistry parameters as well as aquatic organisms including plankton, fishes and macrobenthic invertebrates. Results of laboratory bioassays and benthic community sampling data have been interpreted and related to potential contamination within aquatic habitats.

Federal Aviation Administration – Atlantic City, NJ (Ecologist: 2004 – 2005)
Mr. Heim conducted a fish community assessment that involved intensive sampling via a variety of methods to determine fish populations, growth rates, condition factors (Fulton and Relative Weight) and overall productivity within two reservoirs in southern New Jersey. Over 6,600 fishes representing 10 species were captured and processed during the study. Each fish was measured, weighed, and marked (Floy T-bar anchor tag or dorsal spine clip) with a representative sampling of fish scale samples collected for age and growth rate analysis. The results of the sampling and subsequent analyses were used by Mr. Heim to assess the relative health and productivity of the fish populations within the two reservoirs and to specifically evaluate the impacts (if any) on the fisheries from anthropogenic mercury inputs.
Montello Brownfields Site – Brockton, MA (Ecologist: 2004)
Mr. Heim conducted a Stage II Environmental Risk Characterization (ERC) at the Montello Brownfields Site in Brockton, Massachusetts. The Stage II ERC evaluated the ecological risk associated with several organic and inorganic contaminants detected within the surface waters and/or sediments of Trout Brook and associated wetland located adjacent to the Site. In addition to surface water and sediment sampling, Mr. Heim conducted biological sampling of the macroinvertebrate community present within reaches of Trout Brook adjacent to the Site, downstream of the Site, and upstream of the Site using Rapid Bioassessment Protocol (RBP) methodology. The three primary components of the RBP are: 1) physical and chemical measurements; 2) habitat assessment; and 3) biological survey. The results of the RBP analyses were used by Mr. Heim to evaluate whether ecological indicators within the stretch of Trout Brook on the

Site and downstream of the Site are consistent with ecological indicators present immediately upstream of the Site. Based on the observed results, remediation of Trout Brook was not deemed necessary.

Midwestern Gas Transmission Company, Eastern Extension Project – Sumner County, TN (Ecologist: 2006)
Mr. Heim conducted a biological survey for four rare darter species at 16 stream crossings by a proposed natural gas pipeline. The survey was conducted using a backpack electroshocking unit and captured fish were identified and released. Two of the four rare darter species were found to occur within a specific creek at three different locations. Findings and recommendations for minimizing impacts at the proposed stream crossing locations where the darters occur were provided to the Tennessee Wildlife Resources Agency.

Burlington Northern and Santa Fe Railway Facility – West Burlington, IA, (Ecologist: 2004)
Mr. Heim prepared a biological assessment to evaluate potential impacts associated with exposure by ecological receptors to contaminants identified in surface water and sediment samples collected from a small perennial stream located adjacent to a railroad facility. The biological assessment quantitatively compared the reaches of the stream where contaminants were detected to upgradient reaches. The biological assessment was conducted in accordance with the current Rapid Bioassessment Protocol (RBP) developed by the USEPA for high gradient streams and the Iowa Department of Natural Resource (IDNR) stream biological integrity guidelines. The results of the detailed physicochemical, habitat and biological assessments indicate no adverse impacts to aquatic receptors associated with the presence of contaminants in surface water and sediment in the stream.

Terrestrial Ecology Experience

Mr. Heim conducted wildlife habitat evaluations utilizing a variety of methodologies (Habitat Evaluation Procedures, Golet method, and species-specific habitat assessments). He has extensive experience in preparing detailed wildlife species lists for habitat cover types and conducting wildlife sampling programs utilizing a variety of methodologies including transect surveys and variable-circular plots (avian species), live-trapping (small mammals), scent post surveys, and winter track count surveys. Impact studies from proposed development activities on listed rare species habitats have also been conducted by Mr. Heim. Habitat assessments have also been conducted using Habitat Evaluation Procedures (HEP) developed by the U.S. Fish and Wildlife Service to evaluate impacts associated with proposed developments. Vegetation has been

sampled utilizing random quadrants and plots within identified vegetative cover types. Detailed species lists have also been prepared for sampled habitats.

Federal Aviation Administration Technical Center, Cooper's Hawk Survey – Pleasantville, NJ (Ecologist: 2003)
A survey for active nest sites of the state-threatened Cooper's hawk was undertaken by Mr. Heim on a portion of the approximately 5,000-acre FAA William J. Hughes Technical located in the Pinelands National Reserve in southern New Jersey. TRC conducted the surveys using transects within areas of suitable habitat to detect Cooper's hawks through direct observation or vocalization. In addition, playback recordings were also conducted in an attempt to elicit vocal responses. One active Cooper hawk nest site was located and documented by Mr. Heim. The results of the study will be used to assess the impacts and propose mitigation measures to the breeding Cooper's hawks from groundwater remediation activities proposed in the vicinity.

Orange and Rockland Utilities, Rare Species Surveys, Line 60 Reconductoring Project – Rockland County, NY (Project Manager: 2006)
Mr. Heim was project manager for evaluating habitat and potential impacts to the bog turtle (*Clemmys muhlenbergii*), timber rattlesnake (*Crotalus horridus)*, and Allegheny woodrat (*Neotoma magister*) from a 10-mile transmission line reconductoring project. The bog turtle is a federal and state endangered species while the rattlesnake and woodrat are state-listed threatened and endangered species, respectively. A Phase 1 Bog Turtle Habitat Survey was conducted and submitted to the U.S. Fish and Wildlife Service. This survey concluded that potential bog turtle habitat was not present within the project area. A report summarizing rattlesnake/woodrat habitat survey results was also prepared. This report also provided appropriate recommendations to minimize impacts to these state-listed species.

Armenia Mountain Wind Energy Project – PA (Ecologist: 2007-2008)
A wind energy farm was proposed within 10,000 acres of leased land located in northcentral Pennsylvania. Mr. Heim oversaw a plant survey for *Gaultheria hispidula*, a state-listed Species of Special Concern within the project area. Mr. Heim found two populations of *Gaultheria hispidula* and prepared a report detailing the survey methodology, results and anticipated effects to the rare plants from the proposed project. The Pennsylvania Department of Conservation and Natural Resources (DCNR) approved the report and requested monitoring of the populations for a period of five years. A monitoring program was subsequently submitted and approved by the DCNR.

KeySpan Energy, 250 MW Spagnoli Road Energy Center – Huntington, NY (Project Ecologist: 2001 – 2002)
Mr. Heim served as Project Ecologist for the preparation of natural resource sections of an Article X Preliminary Scoping Statement and an Article X Application for a 250 MW combined cycle power project to be constructed by

KeySpan Energy Development Corporation in the town of Huntington, Suffolk County, New York. Responsibilities included preparation of an ecological effects assessment regarding wetlands, vegetation and wildlife and presented expert testimony during the administrative hearings. The Article X Certificate was issued in 2003.

Atlantic City International Airport, Pilot Mitigation Program and Grassland Restoration – NJ (Project Manager: 2003 – 2006)
Mr. Heim was project manager for a grassland study at the Atlantic City Airport that provides valuable habitat for a number of rare avian (i.e. grasshopper sparrow and upland sandpiper) and lepidopteran species. The study characterized important vegetation and soil features within several reference grassland communities by identifying dominant grasses and herbs, tree and shrub seedlings, as well as depth and physical and chemical soil properties. The study assessed the driving mechanisms behind the reference grassland plant community and the important plant species in the community. The results of the characterization were analyzed to determine the optimum conditions for proposed grassland mitigation. Pilot mitigation plots were subsequently planted in several barren areas to evaluate the feasibility of re-establishing grassland habitat for both rare lepidopteran and avian species.

Islander East Proposed Gas Pipeline – Long Island, NY (Ecologist: 2003)
In response to NYSDEC concerns over impacts to four state-listed rare plant species potentially present within the pipeline right-of-way, Mr. Heim oversaw the preparation of a NYSDEC-approved quantitative rare plant survey methodology as well as the survey itself. A population of the endangered plant *Carex bullata* (button sedge) was identified by Mr. Heim during the field survey. The extent of this population was subsequently mapped in order to ensure that the construction of the proposed pipeline avoided impacts to this population.

University of Connecticut Landfill – Storrs, CT (Ecologist: 2001)
Mr. Heim conducted a site inspection of a former landfill facility to characterize habitats and conduct a survey for ecological receptors inhabiting three wetlands that were present adjacent to the landfill. Characterization of site wetland habitats included identifying dominant plant species and other important features that may allow or preclude wildlife use of the site. The site characterization focused on the wetlands' potential to provide important habitat requirements for wildlife as well as to identify wildlife usage of the site wetlands through visual observation, auditory detection, and sign (e.g., tracks, nests). Results of the site inspection concerning the habitat characterization and the presence of ecological receptors on the site were presented by Mr. Heim. A list of wildlife species and their respective foraging guild were presented as part of the report. The list was based on the identification of wildlife species noted during the site inspection as well as on site characteristics that may provide habitat for additional wildlife. A vernal pool providing potential habitat for an observed state-listed rare salamander species was identified within one of the adjacent wetlands.

Federal Aviation Administration William J. Hughes Technical Center, Forest Mitigation Bank Study and Management Plan – NJ (Project Manager: 2002)
Mr. Heim was project manager for a forest habitat characterization and management study that described existing forest mitigation sites, predicted future forest stand characteristics based on the composition of the existing community and developed habitat management goals to benefit the avian species of concern. Mr. Heim oversaw the collection of data to characterize dominant herbs, tree and shrub seedlings, and substrate cover type within four forest mitigation areas. The species composition of basal sprouts, discrete saplings, and mature shrubs were also assessed and predictions for the forest mitigation areas were developed. Mr. Heim identified a variety of appropriate habitat management strategies, including such silvicultural activities as selective thinning, to optimize forested habitat features for the avian species of concern.

SPECIALIZED TRAINING

- OSHA Hazardous Waste Site Training, 40 hours, 1992
- OSHA 8-Hour Refresher Course, 1993-2007
- OSHA 8-Hour HAZMAT/Supervisor, 1999
- USFWS Habitat Evaluation Procedures (HEP), 1986
- Soil Science Coursework (13 credit hours)

PROFESSIONAL AFFILIATIONS

- Society of Environmental Toxicology and Chemistry
- Society of Wetland Scientists
- Society for Conservation Biology

ELIZABETH A. DENLY

EDUCATION

B.A., Chemistry, University of New Hampshire, 1987

PROFESSIONAL REGISTRATIONS /CERTIFICATIONS

Licensed Site Professional Association, Massachusetts, Associate Member
American Chemical Society

AREAS OF EXPERTISE

Ms. Denly has 23 years of experience in:

- Quality Assurance/Quality Control
- Data Validation
- PCB Investigation and Remediation
- PCB Building Materials
- Remedial Investigation/Feasibility Studies
- Laboratory Audits
- Gas Chromatography: Field and Laboratory Analyses
- Gas Chromatography/Mass Spectrometry: Field and Laboratory Analyses

REPRESENTATIVE EXPERIENCE

Quality Assurance/Quality Control

As a QA chemist at TRC, Ms. Denly is responsible for providing QA/QC oversight in support of a variety of environmental investigations including contaminant ambient air monitoring, human health and ecological risk assessments, risk-based soil cleanups, remediation programs, and delineation. Ms. Denly has provided this oversight under different regulatory programs, including MADEP, NYSDEC, NJDEP, Region I, Region II, Region III, and Region V. In this role, she has been responsible for the preparation of the project-specific QAPP, coordination with the laboratory, selection of the appropriate analytical methodologies needed to achieve the desired state or regulatory standards, oversight and performance of the data validation process, and determination of the usability of the data in comparison to the overall project objectives.

In addition, Ms. Denly serves as the TRC Remediation Practice Quality Coordinator, responsible for the creation and implementation of the TRC Remediation Practice Quality Management Plan and SOPs.

Data Validation

Ms. Denly provides oversight and senior review on data validation performed for a variety of analytical parameters. She performs data validation for organic parameters including VOCs, SVOCs, Pesticides, PCB Aroclors, PCB homologues/congeners, dioxins, specialty analyses including GC/MS/SIM and various air analyses. Validation and reporting guidelines utilized include EPA

National Functional Guidelines, EPA Regions I through V, NYSDEC, and NJDEP. Ms. Denly developed internal protocols for the validation of the MA DEP EPH/VPH methodologies.

New York City School Construction Authority – New York, NY (Project QA Officer: 2010 – Present)
Ms. Denly assisted in the preparation of QA protocols for a comprehensive pilot study to evaluate the possible presence of PCB Caulk and preferred remedial remedies in select schools built between 1950 and 1978. QA protocols included sampling and analysis procedures for PCBs in several matrices (caulk, wipes, soil, air and bulk). Ms. Denly is responsible for reviewing field team documentation, providing oversight of the analytical laboratory and coordinating data validation for all parameters. She communicates frequently with the laboratories to ensure proper receipt of samples, proper utilization of project-specific analytical protocols in order to achieve necessary project action levels and to monitor the overall performance of the laboratories. She works with the laboratories to ensure proper cleanup procedures are performed on difficult bulk matrices from the school buildings to ensure the highest level of data defensibility.

City of New Bedford, Parker Street Waste Site – New Bedford, MA (Project QA Manager: 2006 – Present)
Ms. Denly serves as Project QA Manager and PCB chemistry expert for numerous investigations and remediations associated with historic PCB impacts from the Parker Street Waste Site. Investigation and remediation locations include residential properties, school building sites, and commercial sites within the footprint of the former waste site. Responsibilities include reviewing all field notes, performing data validation, preparing of data usability assessments and overseeing the analytical laboratories.

City of New Bedford, New Bedford High School Investigation and Remediation , New Bedford, MA (Project QA Manager: 2006 – Present)
Ms. Denly serves as Project QA Manager and PCB chemistry expert for the investigation and remediation of multiple PCB containing building materials. Responsibilities include reviewing all field notes, performing data validation, preparing of data usability assessments and overseeing the analytical laboratories.

Curtis Specialty Papers, Pre-Remedial Investigations and Early Removal Action – Milford, NJ (Project QA Officer: 2008 - 2009)
Ms. Denly was the Project QA Officer for pre-RI/FS activities and early removal actions for the removal of oil-filled electrical equipment at this newly-named Superfund site. She was responsible for preparing a QAPP using the UFP-QAPP guidelines in accordance with EPA Region 2 requirements. The investigation a pre-demolition hazardous materials survey, including asbestos sampling, lead-based paint sampling and characterization of other potentially

hazardous building materials and the removal and disposal of over 90 pieces of oil-filled electrical equipment, including PCB and PCB-contaminated transformers. Ms. Denly was responsible for providing oversight of the analytical laboratories and all data validation activities.

Crown Vantage Landfill, Remedial Investigations/Feasibility Studies – Alexandria Township, NJ (Project QA Officer: 2007 – 2010)
Ms. Denly was the Project QA Officer for RI/FS activities at this Superfund site. She was responsible for preparing a QAPP using the UFP-QAPP guidelines in accordance with EPA Region 2 requirements. The remedial investigation including test pitting and soil, sediment, surface water and pore water sampling activities for several analytical parameters. Ms. Denly worked with the human health and ecological risk assessors to ensure the analytical methods selected for the program would achieve the necessary risk-based action levels. Ms. Denly was responsible for providing oversight of the analytical laboratories and all data validation activities.

Woodbrook Road Superfund Site – South Plainfield, NJ (Project QA Officer: 2006 – 2009)
Ms. Denly developed QAPP for complex remedial investigation under EPA Region II oversight. Program involves use of the TRIAD approach for real-time PCB results and sampling and analysis of soil, sediment, groundwater, and surface water for all TCL/TAL parameters, dioxins/furans, PCB congeners, and a variety of wet chemistry parameters, most of which will be used in a human health/ecological risk assessment. Providing oversight of three analytical laboratories and responsible for coordination of data validation for all parameters. She communicates frequently with the laboratories to ensure proper receipt of samples, proper utilization of project-specific analytical protocols in order to achieve necessary project action levels and to monitor the overall performance of the laboratories. Ms. Denly is responsible for the oversight and performance of field and laboratory audits.

130 Liberty Street – New York, NY (Project QA Officer: 2005 – Present)
Ms. Denly developed QAPP for extensive ambient air monitoring program and waste management program under EPA Region II oversight. Provide oversight of six analytical laboratories and responsible for coordination and performance of data validation for asbestos, metals, dioxins/furans, PAHs, PCBs, and silica ambient air data as well as TCLP and metals waste stream data. Communicate frequently with the laboratories to ensure proper receipt of samples, proper utilization of project-specific analytical protocols and to monitor the overall performance of the laboratories. Responsible for the oversight and performance of field and laboratory audits. Review all data prior to web-site posting and submission to EPA.

FAA, Region II – Atlantic City, NJ (Project QA Officer: 2002 – Present)
Ms. Denly assisted in the preparation of QA protocols for the Supplemental RI and Ecological Risk Assessment Work Plan. She was responsible for providing QA support to field team. Interfaced with laboratories to ensure achievement of risk-based standards. Performed data validation and/or oversight for all data generated. Ms. Denly provided oversight for all validation performed on Remedial Investigation data.

Mattiace Petrochemical – Glen Cove , NY (Project QA Officer: 2004 – Present)
Ms. Denly prepared QAPP for Long Term Remedial Action under TRC's Exit Strategy program using Region II guidance. She provided QA oversight to field team. Ms. Denly performed data validation of data generated for demonstration of achievement of cleanup objectives. Responsible for performing assessment of data to determine overall usability.

Region I Auto Body Shop Air Monitoring – Lawrence, MA (Project QA Officer: 2006 – 2008)
Ms. Denly developed QAPP for air monitoring program for chemicals associated with spray painting operations under EPA Region I oversight. She provided oversight of analytical laboratories and responsible for data review of VOC and hexamethylene diisocyanate air data.

QWDC – Long Island City, NY (Project QA Officer: 2003 – Present)
Ms. Denly prepared QAPP for NYSDEC Voluntary Cleanup Program under TRC's Exit Strategy program. She provided QA oversight to field team. Ms. Denly performed data validation for the program. She was responsible for performing assessment of data to determine overall usability. Ms. Denly provided daily support to project team on chemistry, laboratory, and QA issues. She was responsible for ensuring project objectives are achieved by laboratory and for oversight of laboratory QA issues.

First Avenue – New York, NY (Project QA Officer: 2002 – Present)
Ms. Denly prepared a QAPP for Supplemental Soil Investigation and Voluntary Cleanup of four sites under TRC's Exit Strategy program. She provided QA oversight to field team. Perform data validation of select data points used for decision-making. Ms. Denly was responsible for performing assessment of data to determine overall usability for various Remedial Work Plans.

Region I Superfund RAC – MA (Lead Chemist: 2000 – Present)
Ms. Denly served as lead chemist for a variety of Superfund programs under the Region I Remedial Action Contract (RAC) as a subcontractor to Metcalf & Eddy. Her responsibilities include ongoing development of analytical specifications for laboratories to follow in order to achieve specific project objectives and development of QAPPs following the requirements of EPA Region I QAPP guidelines. She performs data validation and/or senior review of data validation

for a variety of analytical methodologies utilizing EPA Region I validation guidelines. Ms. Denly generates data usability assessments and/or split sample comparison reports in accordance with EPA Region I guidance, when required. She interacts with EPA Region I chemists in the selection of analytical methodologies and project objectives. Ms. Denly provides QA oversight of PRP's validation reports, sampling and analysis plans, and QAPPs. She is responsible for providing QA oversight to field team, performing daily reviews of COCs and traffic reports, acting as the main liaison between Metcalf & Eddy and the field team and with EPA.

Various Brownfields Programs – Throughout MA (Project QA Officer: 2000 –Present)
Ms. Denly serves as Project QA officer for a variety of Brownfields programs performed throughout Massachusetts. Her responsibilities include development and approval of QAPPs, selection and oversight of laboratories, and providing a final data usability assessment at the close of each project. Ms. Denly is responsible for providing QA oversight to field team and performing daily reviews of COCs.

Massachusetts Department of Environmental Protection – MA (QA Consultant: 1998 – Present)

2010-Present: VPH by GC/MS: Ms. Denly provides assistance to MassDEP in the development of a protocol for the analysis of VPH by GC/MS. Ms. Denly coordinates associated MassDEP Work Group meetings. Ms. Denly will be responsible for providing MassDEP with a draft version of this method.

2010-Present: Compendium of Analytical Methods (CAM) Q&A: Ms. Denly provides assistance to MassDEP on all questions received regarding the CAM. She is responsible for generating a response to each question and tracking all questions and answers for subsequent posting on the MassDEP web site.

2008-2010: CAM Revisions: In conjunction with MassDEP, Ms. Denly revised and updated the CAM documents that instruct laboratories on how to perform common analytical methods under the MCP. The CAM documents detail quality control procedures, acceptance criteria, corrective actions, and reporting requirements that laboratories must follow when performing analyses under the MCP. Ms. Denly is actively involved with the technical review and update of existing CAM documents, which includes analytical methods for VOCs, SVOCs, pesticides, PCBs, herbicides, explosives, EPH, VPH, metals, cyanide, and hexavalent chromium. Ms. Denly's responsibilities also included the creation of new CAM documents for MassDEP's air-phase petroleum hydrocarbons (APH) method and EPA method TO-15 analyses. When the revisions were finalized, Ms. Denly provided training for laboratories and LSPs on the new and revised CAM documents.

2006-2007: MassDEP Data Audit Project: Ms. Denly was responsible for performing review/evaluation of data packages for EPH/VPH analyses from laboratories selected by MassDEP as part of a Data Audit project to ensure compliance with the methods and CAM. All laboratory reports which were reviewed were randomly selected by MassDEP from different MCP sites. As part of the evaluation, she developed worksheets that can be used in the future by MassDEP auditors for EPH and VPH data. In addition, Ms. Denly provided MassDEP with a final report summarizing the results of the data audits.

2006-2007: Data Usability Work Group: Ms. Denly served as a member of the Data Usability Work Group led by MassDEP and assisted in the development of a policy for Representativeness Evaluations and Data Usability Assessments (REDUA) under the MCP for RAOs. Ms. Denly has extensive experience in generating data usability assessments in conformance with this policy as well as with a wide variety of data sets and scenarios.

2003-2004: Revisions & Updates to EPH/VPH Methods: Ms. Denly served as a member of the EPH/VPH Revisions Work Group led by MassDEP. The Work Group was responsible for updating the 1998 EPH/VPH methods based on laboratory's experiences with the methods since it was released. As a result of serving on this Work Group, Ms. Denly was subsequently contracted by MassDEP to provide final documents for the revised EPH/VPH methods.

2001-2004: Data Quality Enhancement Work Group: Ms. Denly served as a member of the Data Quality Enhancement Work Group led by MassDEP and assisted in the development of a policy for achieving consistency of data reported under the MCP. Ms. Denly was designated as the Organic Subcommittee Chairperson on this Work Group, responsible for generating the framework for QC parameters on organic analyses typically utilized under the MCP, method-specific performance standards for these QC parameters, minimum reporting requirements for the laboratories for each method, and a list of what laboratories need to keep on file for potential audits by the MassDEP. She was responsible for generating the final deliverable on all organic method requirements developed under this Work Group, providing significant input into the development of requirements for inorganic methods as well as field sampling QC requirements, and LSP data usability assessment requirements.

1998-2000: Development of the APH Method: Ms. Denly managed a program involving the development of an analytical approach for the analysis of volatile petroleum hydrocarbons in indoor air to support the MA DEP's risk-based approach to evaluating petroleum hydrocarbons in air. She developed a list of target analytes and a QAPP for the program. Ms. Denly performed method detection limit studies for individual target analytes and hydrocarbon ranges in SUMMA canisters. She conducted a precision and accuracy study for individual target analytes and hydrocarbon ranges using an outside source. Ms. Denly also evaluated the method with real-world samples. As a result of the method

development, MassDEP issued the APH method for analysis of air-phase petroleum hydrocarbons in air samples.

Greenfields Energy Company, Ltd. – WV (QA Coordinator: 1999 – 2000)
Ms. Denly served as QA coordinator for a Phase II Investigation at a former coal producing facility in West Virginia. She provided oversight to another consultant in the development of the QAPP. Interfaced with the laboratory to develop appropriate low level methodologies for groundwater samples in order to achieve West Virginia Groundwater Standards. Ms. Denly communicated daily with the laboratory to ensure samples received for proper analytical parameters. She also coordinated and performed data validation of all data for a complex mixture of organic and inorganic methodologies.

New Bedford Harbor – New Bedford, MA (Project QA Officer: 1998 – 2000)
Ms. Denly provided oversight of a laboratory which served as a QA laboratory for baseline analyses of air, groundwater, and sediment samples at a Superfund site under USACE and EPA Region I oversight. She is responsible for coordination and performance of data validation. Ms. Denly developed project-specific worksheets for the validation of PCB congener analyses of PUF/XAD samples by HRGC/HRMS using EPA Region I guidelines. She communicated frequently with the laboratory to ensure proper receipt of samples and proper utilization of project-specific analytical protocols and to monitor the overall performance of the laboratory. Ms. Denly is responsible for the generation of Chemical Quality Assurance Reports, comparing the results of the QA laboratory with those of a primary laboratory. She communicated frequently with the USACE in regards to laboratory issues.

Allied Products – OH (QA Coordinator: 1999 – 2000)
Ms. Denly served as QA coordinator for a Supplemental Phase II Investigation under the Ohio Voluntary Action Program. She developed project-specific QAPP. Provided support to the project manager including the confirmation of proper QA/QC utilized in the field and laboratory as well as coordinating and performing data validation. Ms. Denly interfaced with the laboratory to select appropriate methodologies for low-level analyses in order to achieve Ohio MCLs.

Union Camp – Dover, OH (QAPP Author: 1998 – 1999)
Ms. Denly assisted in the development of a QAPP under Ohio EPA/Region V in support of a Corrective Measures Study ecological risk assessment. She was responsible for working with contracted laboratories in the development of acceptable analytical methods with very low detection limits for the determination of VOCs, SVOCs, pesticides, and PCBs in complex matrices.

Eagle Picher, OH (Project QA Officer: 1998 – 2000)
Ms. Denly assisted in the development of a QAPP under Ohio EPA/Region V in support of a SACM program. She provided detailed protocols for XRF field screening in QAPP. Coordinated analytical requirements with laboratory. Ms.

Denly also provided oversight and performed data validation using EPA National Functional Guidelines.

Bay State Gas – Brockton and Taunton, MA (Project QA Officer: 1995 – 2000)
Ms. Denly served as quality assurance coordinator for Phase II investigations performed at various Bay State locations under Massachusetts Department of Environmental Protection regulations. She provided QA support to the field sampling team. Ms. Denly also coordinated and performed data validation and monitored laboratory performance. Interfaced with the laboratory to select appropriate analytical methodologies and sample cleanups in order to achieve low detection limits when samples exhibited high petroleum content.

Stanley Bostitch – East Greenwich, RI (QA Coordinator: 1995 – 2000)
Ms. Denly served as analytical coordinator for a large sampling program performed under Rhode Island Department of Environmental Management regulations. She provided QA support to the field sampling team. Ms. Denly coordinated and performed data validation and monitored laboratory performance.

BOC Gases – MA (QA Coordinator: 1997 – 1999)
Ms. Denly served as analytical coordinator for a Massachusetts Contingency Plan (MCP) Phase II investigation. She provided support to the project manager including the confirmation of proper QA/QC utilized in the field and laboratory as well as coordinating and performing data validation. Ms. Denly assisted project manager in the selection of appropriate analytical methodologies (GC/MS/SIM) in order to meet the MADEP GW-1 standards. She also assisted the laboratory in developing specific QA/QC procedures to be utilized with the GC/MS/SIM analyses.

MADEP EPH/VPH Methodologies, Various Clients – MA (QA Consultant 1998 –2000)
Ms. Denly assisted several laboratories in the development and implementation of the recently published MADEP methodologies for the analysis of TPH. She performed intense review of laboratory data and convened with laboratory to discuss deficiencies and potential corrective action.

Field/Laboratory Analyses

Consolidated Edison Company, Electrical Power Generator – NY (Project Chemist: 1996)
Ms. Denly performed a method validation study to establish the applicability of an ASTM UV method for the measurement of dielectric fluids in soils. Detection limits, precision, accuracy, and comparability to laboratory analyses using MA DEP EPH methodology were investigated for each oil.

Consolidated Edison Company, Electrical Power Generator – NY (GC Analyst: 1995)
Ms. Denly prepared and analyzed soil samples for an RFI of the facility in Astoria, New York. She quantitatively identified samples for TPH by GC/FID. Ms. Denly performed qualitative identification of the soils based on analysis of several of categories of oils used at the facility, including fuel oil #2, fuel oil #6, transformer oil, gas condensate, and dielectric fluids.

Iron Horse Park, Bioremediation – Billerica, MA (Laboratory Analyst: 1995)
Ms. Denly developed extraction and analysis method to determine presence of low level petroleum hydrocarbons (C_{10}-C_{32} normal alkanes and total unresolved TPH) and low level PAHs with their alkylated homologues. She employed GC/FID and GC/MS selective ion monitoring technologies for the analyses. Ms. Denly monitored degree of microbial biodegradation in samples via the quantitative evaluation of hopane in the PAH analysis and the pristane/phytane ratio in the TPH analysis.

Cliffs Dow – Marquette, MI (Field GC/MS Chemist: 1995)
Ms. Denly provided on-site field analytical support during remediation of a site contaminated with wood tars. She utilized an aqueous extraction followed by analysis of headspace constituents for VOCs. Implemented a methylene chloride microextraction followed by GC/MS selective ion monitoring for PAH and phenolic compounds. Ms. Denly provided real-time information which was compared to site-specific clean-up criteria and used to guide the excavation and remediation process. Data correlated well with results from split samples sent to an off-site laboratory for analysis by CLP methodologies.

Allied Signal, Inc., Phenol and Acetone Manufacturer – PA (Field GC Chemist: 1994)
Ms. Denly provided on-site analytical support during a post-control emissions test under EPA's CAAA Early Reductions Program and Philadelphia Air Management Services (PAMS) Compliance Testing for a thermal oxidizer and catalytic oxidizer at the Frankford, Pennsylvania facility. She measured emissions of target Hazardous Air Pollutants (HAPs) in whole air samples using EPA Method 18. Ms. Denly provided on-site sample results as well as emission rates and removal efficiencies.

Compo Chemical Company, Former Adhesives Manufacturer – Mansfield, MA (Field Analytical Chemist: 1996)
Ms. Denly provided field analytical support during a Phase II investigation of a MA DEP listed site in Mansfield, Massachusetts which formerly manufactured adhesives. She analyzed soil samples on site using an aqueous extraction followed by a headspace analysis using a Photovac 10S plus portable GC, the results of which were used to delineate extent of contamination. Ms. Denly provided QA support and guidance during investigation. She prepared the QA

Plan and ensured the implementation of QA requirements including field quality control and data validation.

CRREL – Hanover, NH (Field Chemist: 1998)
Ms. Denly conducted a quantitative tracer gas study with helium during two in-situ air sparging and soil vapor extraction pilot tests at the Cold Regions Research and Engineering Laboratory in Hanover, New Hampshire. She was responsible for setup of all instrumentation, calibration of helium detector, calculations of flow rates, performance of a 100% recovery test, and measurement of helium detected over time.

Squibb Manufacturing, Pharmaceutical Company – Humacao, PR (Field GC Chemist: 1995)
Ms. Denly provided field analytical support for soil gas survey conducted as part of an RFI at the facility in Humacao, Puerto Rico. She analyzed soil gas samples in tedlar bags by direct injection, GC/FID techniques following the guidelines of EPA Method 18 for ten constituents of concern. Ms. Denly generated real-time data used to identify areas of release and select locations of soil remediation.

Sun Refining and Marketing Co., Oil Refinery – Yabucoa, PR (Field GC Chemist: 1994)
Ms. Denly organized and operated an on-site laboratory to support a fugitive emissions screening and bagging program of process equipment within ten process units at the facility in Yabucoa, Puerto Rico. She analyzed tedlar bag matrices following guidelines of EPA Method 18.

Malcolm Pirnie, Wastewater Treatment Facilities – New York City (Laboratory Analyst: 1992)
Ms. Denly refined, organized, and performed innovative analytical methodology used for a large scale program (over 800 samples) as part of a study of VOC air emissions from various wastewater treatment plants.

French Limited Superfund Site – Crosby, TX (GC/MS Analyst: 1987 – 1990)
Ms. Denly supported field bioremediation study work at a Superfund site in Crosby, Texas by analyzing tenax cartridge samples on perimeters of a contaminated lagoon. She conducted method development and analytical modifications to accommodate complex matrix effects resulting from flux chamber sampling techniques.

PUBLICATIONS AND PRESENTATIONS
Denly, E. Chapnick, S., "*Is Presumptive Certainty Generating Usable Data for Massachusetts Contingency Plan (MCP) Decisions?*" Paper presented at Twentieth Annual Conference on Contaminated Soils, Sediments and Waters, Amherst, MA. 2004.

Denly, E., Hoyt, M., Anastas, N., Fitzgerald, J., Hutcheson, M., McGrath, T., *"Massachusetts VPH Method Validation for Indoor Air Samples"*. Poster presented at Thirteenth Annual Conference on Contaminated Soils, Amherst, MA. 1998.

Denly, E. Hopper, D., *"Field Chemistry for PAHs and VOCs Applied to a Risk-Based Soil Cleanup at a Landfill"*, Paper presented at Fifth International Symposium on Field Analytical Methods for Hazardous Wastes and Toxic Chemicals, Las Vegas, NV. 1997.

Denly, E., Hoyt, M., Camp, W.H., Naughton, G., *"Method Validation Study for Field Screening of Dielectric Fluids in Soils"*, Paper presented at Twelfth Annual Conference on Contaminated Soils, Amherst, MA. 1997.

Denly, E., Wang, H., *"Preparation of Tedlar Bag Whole Air Standards with a SUMMA Canister for Field VOC Analysis"*, Poster presented at Fourth International Symposium on Field Screening Methods for Hazardous Waste and Toxic Chemicals, February 22-24, 1995, Las Vegas, NV.

SPECIALIZED TRAINING

- Data Evaluation for Vapor Intrusion Studies, 9/07
- Sediment Toxicity Testing: Methods to Achieve Strong Data Sets and Interpret Results, 6/07
- Assessing the Vapor Intrusion Pathway at Contaminated Sites, NHDES Waste Management Division, 4/05
- Perchlorate Webinar, US EPA, 2/05
- Improved Project Communication: Within and Outside of the Project Team, ASCE Continuing Education Program, 12/15/04
- Communicating with Tact and Skill for Managers and Supervisors, Rockhurst University Continuing Education Center, 2004
- Training Session for USACE-NAE/USEPA Region I Regional Implementation Manual, 10/7/04
- Training for Non-Trainers, US EPA, 9/04
- Overview of Statistical Data Quality Assessment, US EPA, 9/04
- Assessing Quality Systems, US EPA, 9/04
- Understanding and Evaluating Data Quality Assessments, US EPA, 9/28/04
- PowerPoint 2000 – Level 1, New Horizons Computer Learning Centers, 12/03
- EPA Forms II Lite Training Course, 9/23/03
- MA DEP: "Beyond TPH: Understanding and Using the New EPH/VPH Approach"
- Arthur D. Little: "Advanced Chemical Fingerprinting of Petroleum Contaminated Soils and Water"

- ACS Short Course: "How to Develop and Troubleshoot Capillary GC Methods"
- ORA/RSA Workshop: Optical Remote Sensing
- Finnigan MAT: "Basic Mass Spectral Interpretation"
- Finnigan MAT: "Advanced Environmental MS Interpretation"

APPENDIX B

FIELD DATA FORMS

TRC Environmental Corporation 57 E. Willow Street, Millburn, NJ 07041 (973) 564-6006	SOIL BORING LOG	BORING NUMBER
PROJECT NAME:	LOCATION:	
PROJECT NO.:	CONTRACTOR:	DATE DRILLED:
SAMPLER TYPE/DIA.:	DEPTH TO WATER:	DRILLER:
BORING METHOD:	TOTAL DEPTH DRILLED:	LOGGED BY:

DEPTH FROM SURFACE (FEET)	BLOW COUNT PER 6 IN.	RECOVERY (INCHES)	PID (ppm)	SAMPLE DESIGNATION	UNIFIED	LITHOLOGIC CLASSIFICATION AND COMMENTS
0						
1						
2						
3						
4						
5						

APPENDIX C

LABORATORY QA MANUALS

ACCUTEST LABORATORIES

Quality Systems Manual

Volume XII, Revision 0: February 2011

Effective Date: February 24, 2011

Document Control Number: 54

Vincent Pugliese, President

David Speis, Laboratory Director

Phillip Worby, Director, Quality Assurance

Nancy Cole, Technical Director - Inorganics

Wen Wen Chi, Technical Director - Organics

Accutest Laboratories
2235 U.S. Route 130
Dayton, New Jersey 08810
732.329.0200

Introduction

The Accutest Laboratories Quality Assurance System, detailed in this plan, has been designed to meet the quality program requirements of the National Environmental Laboratory Accreditation Conference (NELAC), ISO Guide 17025, ISO Guide 17011, the Department of Defense Environmental Laboratory Approval Program (DOD ELAP) and other National environmental monitoring programs. The plan establishes the framework for documenting the requirements of the quality processes regularly practiced by the Laboratory. The Quality Assurance Director is responsible for changes to the Quality Assurance Program, which is appended to the Quality System Manual (QSM) during the annual program review. The plan is also reviewed annually for compliance purposes by the Company President and Laboratory Director and edited if necessary. Changes that are incorporated into the plan are itemized in a summary of changes following the introduction. Plan changes are communicated to the general staff in a meeting conducted by the Director of Quality Assurance following the plan's approval.

The Accutest plan is supported by standard operating procedures (SOPs), which provide specific operational instructions on the execution of each quality element and assure that compliance with the requirements of the plan are achieved. Accutest employees are responsible for knowing the requirements of the SOPs and applying them in the daily execution of their duties. These documents are updated as changes occur and the staff is trained to apply the changes.

At Accutest, we believe that satisfying client requirements and providing a product that meets or exceeds the standards of the industry is the key to a good business relationship. However, client satisfaction cannot be guaranteed unless there is a system that assures the product consistently meets its design requirements and is adequately documented to assure that all procedural steps are executed, properly documented and traceable.

This plan has been designed to assure that this goal is consistently achieved and the Accutest product withstands the rigors of scrutiny that are routinely applied to analytical data and the processes that support its generation.

Summary of Changes
Accutest Laboratories Quality System Manual – February 2011

Section	Page	Description
----------	-----	Updated Volume Number, Revision Number and Date
2.4	8	Revised Accutest Laboratories Organization Chart
1.2	5	Added to the Policy Statement the following "…and the commitment to the continual improvement of the quality system."
2.1	6	Added to Organization Entity: Scott, Louisiana and Traverse City, Michigan
2.2	6	President/CEO - Changed "six to nine". Added "…Louisiana and Michigan."
2.3	7	Chain of Command – Added Phillip Worby, Director, Corporate Quality Assurance.
7.4	27-28	Change header to Assignment of Reagent, Bulk Chemical and Standard Expiration Dates. Added "Neat materials, bulk chemicals such as solvents, acids…" Added "An expiration date of five (5) years from the date of receipt shall be established."
8.9	31	Method Reporting Limit – Removed "…or equal to…" Added – "The reporting limit established for both organic and inorganic analysis is above the calculated method detection limit where applicable."
Appendix II, III & IV	---	Revisions Applied as Appropriate

Table of Contents

1.0 QUALITY POLICY

1.1 *Accutest Mission*:

Accutest Laboratories provides analytical services to commercial and government clients in support of environmental monitoring and remedial activities as requested. The Laboratory's mission is dedicated to providing reliable data that satisfies client's requirements as explained in the following:

"Provide easy access, high quality, analytical support to commercial and government clients which meets or exceeds data quality objectives and provides them with the data needed to satisfy regulatory requirements and/or make confident decisions on the effectiveness of remedial activities."

These services are provided impartially and are not influenced by undue commercial or financial pressures which might impact the staff's technical judgment. Coincidently, Accutest does not engage in activities that endanger the trust in our independent judgment and integrity in relation to the testing activities performed.

1.2 *Policy Statement*:

The management and staff of Accutest Laboratories share the responsibility for product quality and the commitment to the continual improvement of the quality system. Accordingly, Accutest's quality assurance program is designed to assure that all processes and procedures, which are components of environmental data production, meet established industry requirements, are adequately documented from a procedural and data traceability perspective, and are consistently executed by the staff. It also assures that analytical data of known quality, meeting the quality objectives of the analytical method in use and the data user's requirements, is consistently produced in the laboratory. This assurance enables the data user to make rational, confident, cost-effective decisions on the assessment and resolution of environmental issues.

The laboratory Quality System also provides the management staff with data quality and operational feedback information. This enables them to determine if the laboratory is achieving the established quality and operational standards, which are dictated by the client or established by regulation. The information provided to management, through the QA program, is used to assess operational performance from a quality perspective and to perform corrective action as necessary.

All employees of Accutest Laboratories participating in environmental testing receive quality system training and are responsible for knowing and complying with the system requirements. The entire staff shares Accutest's commitment to good professional practice.

Vincent J. Pugliese, President

February 11, 2011
Date

2.0 ORGANIZATION

2.1 ***Organizational Entity***. Accutest Laboratories is a privately held, independent testing laboratory founded in 1956 and registered as a New Jersey Corporation. The headquarters are located in Dayton, New Jersey where it has conducted business since 1987. Satellite laboratories are maintained in Marlborough, Massachusetts; Orlando, Florida, Houston, Texas, San Jose, California, Wheat Ridge, Colorado, Scott, Louisiana and Traverse City, Michigan.

2.2 ***Management Responsibilities***

Requirement: Each laboratory facility has an established chain of command. The duties and responsibilities of the management staff are linked to the President/CEO of Accutest Laboratories who establishes the agenda for all company activities.

President/CEO. Primary responsibility for all operations and business activities. Delegates authority to laboratory directors, general managers, and the quality assurance director to conduct day to day operations and execute quality assurance duties. Each of the nine operational entities (New Jersey, Florida, Massachusetts, Texas (2), California, Colorado, Louisiana and Michigan) report to the President/CEO.

Vice President Operations/Laboratory Director. Executes day to day responsibility for laboratory operations including technical aspects of production activities and associated logistical procedures. Reports directly to the President/CEO.

Quality Assurance Director. Design, oversight, and facilitation responsibility for all Quality System elements identified in the Quality Program. Reports directly to the President/CEO.

Technical Directors (Organics/Inorganic). Responsible for day to day operations and activities of the organics and inorganics laboratories including scheduling, production and data quality. Reports directly to the Laboratory Director.

Department Managers. Executes day to day responsibility for specific laboratory areas including technical aspects of production activities and associated logistical procedures. Direct report to the laboratory director.

Section Supervisors. Executes day to day responsibility for specific laboratory units including technical aspects of production activities and associated logistical procedures. Direct report to the Department Manager.

2.3 *Chain of Command*

The responsibility for managing all aspects of the Company's operation is delegated to specific individuals, who have been assigned the authority to act in the absence of the senior staff. These individuals are identified in the following Chain of Command:

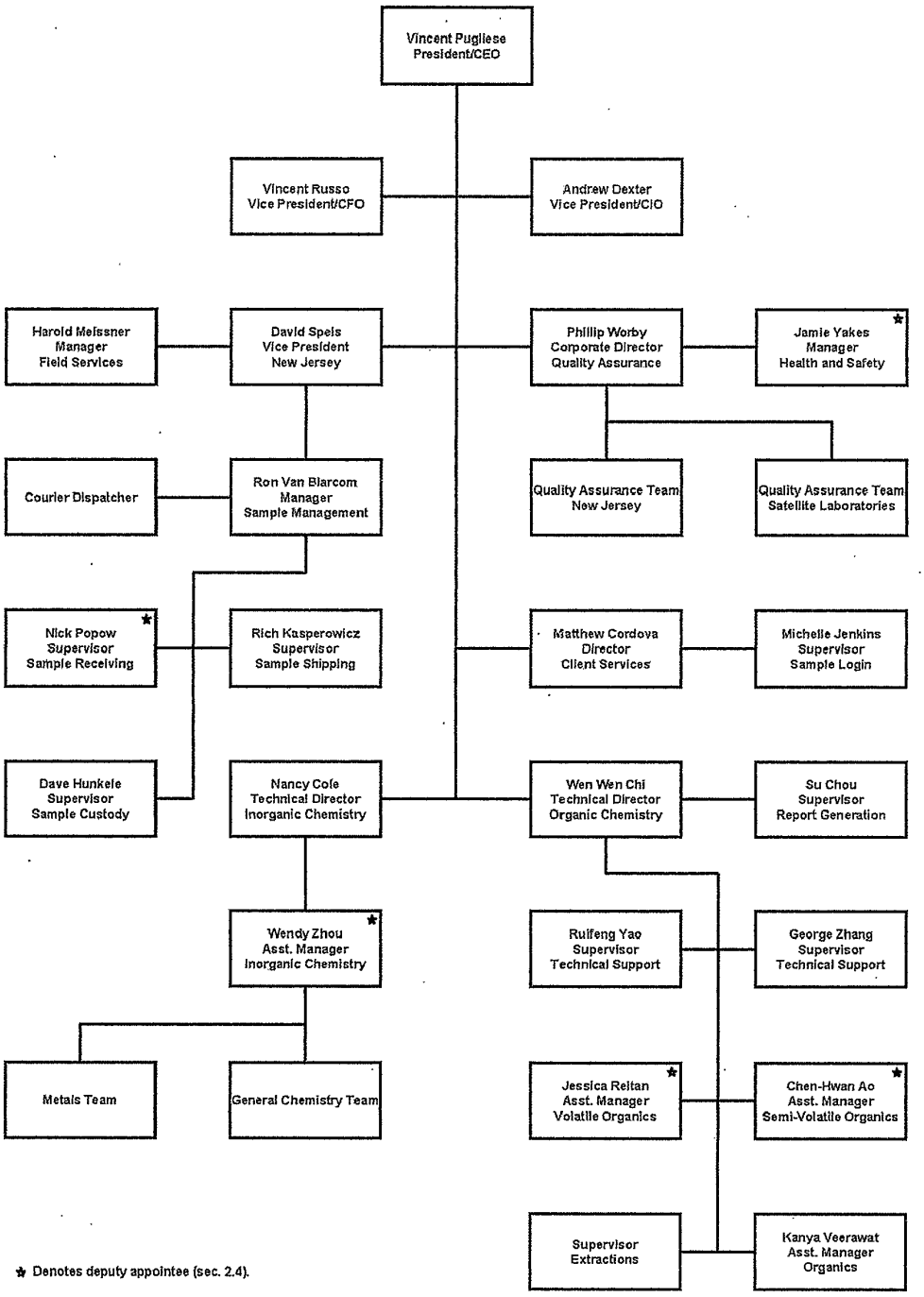
Vince Pugliese; President and Chief Executive Officer
Vince Russo; Chief Financial Officer
David Speis; Vice President Laboratory Operations & Laboratory Director
Phillip Worby, Director, Corporate Quality Assurance
Matt Cordova, Director, Client Services

2.4 *Organization Chart*

The hierarchy of the Company's operational control and oversight is illustrated in the Accutest Laboratories Organization Chart. Employees listed with an asterisk would be considered to be the appointed deputy in the event that the technical director or corporate quality assurance director are absent from their respective position for a period of time exceeding fifteen (15) consecutive calendar days. If this absence exceeds thirty-five (35) consecutive calendar days the laboratory shall notify the NJDEP-Office of Quality Assurance in writing.

Should this absence exceed sixty-five consecutive calendar days the DOD ELAP Accrediting Body shall be notified in writing.

Accutest Laboratories Mid-Atlantic Organization Chart



★ Denotes deputy appointee (sec. 2.4).

3.0 QUALITY RESPONSIBILITIES OF THE MANAGEMENT TEAM

3.1 ***Requirement***: Each member of the management team has a defined responsibility for the Quality System. System implementation and operation is designated as an operational management responsibility. System design and implementation is designated as a Quality Assurance Responsibility.

President/CEO. Primary responsibility for all quality activities. Delegates program responsibility to the Quality Assurance Director. Has the ultimate responsibility for implementation of the Quality System.

Vice President Operations/Laboratory Director. Responsible for implementing and operating the Quality System in all laboratory areas. Responsible for the design and implementation of corrective action for defective processes. Has the authority to delegate Quality System implementation responsibilities.

Quality Assurance Director. Responsible for design, implementation support, training, and monitoring of the quality system. Identifies product, process, or operational defects using statistical monitoring tools and processes audits for elimination via corrective action. Empowered with the authority to halt production if quality issues warrant immediate action. Monitors implemented corrective actions for compliance.

Technical Directors. Responsible for overseeing the technical aspects of the quality assurance system as they are integrated into method applications and employed to assess analytical control on a daily basis. The Technical directors review and acknowledge the technical feasibility of proposed QA systems involving technical applications of applied methodology.

Department Managers. Responsible for applying the requirements of the Quality System in their section and assuring subordinate supervisors and staff apply all system requirements. Initiates, designs, documents, and implements corrective action for quality deficiencies.

Section Supervisors & Team Leaders. Responsible for applying the requirements of the Quality System to their operation and assuring the staff applies all system requirements. Initiates, designs, documents, and implements corrective action for quality deficiencies.

Quality Assurance Officers. Responsible for design support, implementation support, training, and monitoring support for the quality system. Conducts audits and product reviews to identify product, process, or operational defects using statistical monitoring tools and processes audits for elimination via corrective action. Provides monitors support for implemented corrective actions for compliance. Serves as the primary alternate in the absence of the Quality Assurance Director.

Bench Analysts. Responsible for applying the requirements of the Quality System to the analyses they perform, evaluating QC data and initiating corrective action for quality control deficiencies within their control. Implements global corrective action as directed by superiors.

3.2 ***Program Authority***. Authority for program implementation originates with the President/CEO who bears the ultimate responsibility for system design, implementation, and enforcement of requirements. This authority and responsibility is delegated to the Director of Quality Assurance who performs quality functions independently without the encumbrances or biases associated with operational or production responsibilities to ensure an honest, independent assessment of quality issues.

3.3 ***Data Integrity Policy***. The Accutest Data Integrity Policy reflects a comprehensive, systematic approach for assuring that data produced by the laboratory accurately reflects the outcome of the tests performed on field samples and has been produced in a bias free environment by ethical professionals. The policy includes a commitment to technical ethics, staff training in ethics and data integrity, an individual attestation to data integrity and procedures for evaluating data integrity. Senior management assumes the responsibility for assuring compliance with all technical ethics elements and operation of all data integrity procedures. The staff is responsible for compliance with the ethical code of conduct and for practicing data integrity procedures.

The Accutest Data Integrity Policy is as follows:

"Accutest Laboratories is committed to producing data that meets the data integrity requirements of the environmental regulatory community. This commitment is demonstrated through the application of a comprehensive data integrity program that includes ethics and data integrity training, data integrity evaluation procedures, staff participation and management oversight. Adherence to the specifications of the program assures that data provided to our clients is of the highest possible integrity and can be used for decision making processes with high confidence."

Data Integrity Responsibilities

Management. Senior management retains oversight responsibility for the data integrity program and retains ultimate responsibility for execution of the data integrity program elements. Senior management is responsible for providing the resources required to conduct ethics training and operate data integrity evaluation procedures. They also include responsibility for creating an environment of trust among the staff and being the lead advocate for promoting the data integrity policy and the importance of technical ethics. The Quality Assurance Director is the designated ethics officer for the Company.

Staff. The staff is responsible for adhering to the company ethics policy as they perform their duties and responsibilities associated with sample analysis and reporting. By executing this responsibility, data produced by Accutest Laboratories retains its high integrity characteristics and withstands the rigors of all data integrity checks.

The staff is also responsible for adhering to all laboratory requirements pertaining to manual data edits, data transcription and data traceability. These include the application of approved manual peak integration and documentation procedures. It also includes establishing traceability for all manual results calculations and data edits.

Ethics Statement. The Accutest ethics statement reflects the standards that are expected for businesses that provide environmental services to regulated entities and regulatory agencies on a commercial basis. The Ethics Policy is comprised of key elements that are essential to organizations that perform chemical analysis for a fee. As such, it focuses on elements related to personal, technical and business activities.

Accutest Laboratories provides analytical chemistry services on environmental matters to the regulated community. The data the company produces provides the foundation for determining the risk presented by a chemical pollutant to human health and the environment. The environmental industry is dependent upon the accurate portrayal of environmental chemistry data. This process is reliant upon a high level of scientific and personal ethics.

It is essential to the Company that each employee understands the ethical and quality standards required to work in this industry. Accordingly, Accutest has adopted a code of ethics, which each employee is expected to adhere to as follows:

- Perform chemical and microbiological analysis using accepted scientific practices and principles.
- Perform tasks in an honest, principled and incorruptible manner inspiring peers & subordinates.
- Maintain professional integrity as an individual.
- Provide services in a confidential, honest, and forthright manner.
- Produce results that are accurate and defensible.
- Report data without any considerations of self-interest.
- Comply with all pertinent laws and regulations associated with assigned tasks and responsibilities.

Data Integrity Procedures. Four key elements comprise the Accutest data integrity system. Procedures have been implemented for conducting data integrity training and for documenting that employees conform to the Accutest Data Integrity and Ethics policy.

The data integrity program consists of routine data integrity evaluation and documentation procedures to periodically monitor and document data integrity. These procedures are documented as SOPs. SOPs are approved and reviewed annually following the procedures employed for all Accutest SOPs. Documentation associated with data integrity evaluations is maintained on file and is available for review.

Data Integrity Training. Accutest employees receive technical ethics training during new employee orientation. Employees are also required to refresh their ethical conduct agreement

annually, which verifies their understanding of Accutest's ethics policy and their ethical responsibilities. A brochure summarizing the details of the Accutest Data Integrity Policy is distributed to all employees with the Ethical Conduct Agreement. The refreshed agreement is appended to each individual's training file.

The training focuses on the reasons for technical ethics training, explains the impact of data fraud on human health and the environment, and illustrates the consequences of criminal fraud on businesses and individual careers. Accutest's ethics policy and code of ethics are reviewed and explained for each new employee.

Training on data integrity procedures are conducted by individual departments for groups involved in data operations. These include procedures for manual chromatographic peak integration, traceability for manual calculations and data transcription.

Data Integrity Training Documentation. Records of all data integrity training are maintained in individual training folders. Attendance at all training sessions is documented and maintained in the training archive.

Accutest Data Integrity and Ethical Conduct Agreement. All employees are required to sign a Data Integrity and Ethical Conduct Agreement annually. This document is archived in individual training files, which are retained for duration of employment.

The Data Integrity and Ethical Conduct Agreement is as follows:

I. *I understand the high ethical standards required of me with regard to the duties I perform and the data I report in connection with my employment at Accutest Laboratories.*

II. *I have received formal instruction on the code of ethics that has been adapted by Accutest Laboratories during my orientation and agree to comply with these requirements.*

III. *I have received formal instruction on the elements of Accutest Laboratories' Data Integrity Policy and have been informed of the following specific procedures:*

   a. *Formal procedures for the confidential reporting of data integrity issues are available, which can be used by any employee,*

   b. *A data integrity investigation is conducted when data issues are identified that may negatively impact data integrity.*

   c. *Routine data integrity monitoring is conducted on sample data, which may include an evaluation of the data I produce,*

IV. *I have read the brochure detailing Accutest Laboratories Data Integrity and Ethics Program as required.*

V. *I am aware that data fraud is a punishable crime that may include fines and/or imprisonment upon conviction.*

VI. I also agree to the following:

a. *I shall not intentionally report data values, which are not the actual values observed or measured.*

b. *I shall not intentionally modify data values unless the modification can be technically justified through a measurable analytical process.*

c. *I shall not intentionally report dates and times of data analysis that are not the true and actual times the data analysis was conducted.*

d. *I shall not condone any accidental or intentional reporting of inauthentic data by other employees and immediately report it's occurrence to my superiors.*

e. *I shall immediately report any accidental reporting of inauthentic data by myself to my superiors.*

Data Integrity Monitoring. Documented procedures are employed for performing data integrity monitoring. These include regular data review procedures by supervisory and management staff (Section 12.7), supervisory review and approval of manual integrations and periodic reviews of GALP audit trails from the LIMS and all computer controlled analysis.

Data Review. All data produced by the laboratory undergoes several levels of review, which includes two levels of management review. Detected data anomalies that appear to be related to data integrity issues are isolated for further investigation. The investigation is conducted following the procedures described in this section.

Manual Peak Integration Review and Approval. Routine data review procedures for all chromatographic processes includes a review of all manual chromatographic peak integrations. This review is performed by the management staff and consists of a review of the machine integration compared to the manual integration. Manual integrations, which have been performed in accordance with Accutest's manual peak integration procedures, are approved for further processing and release. Identification of samples and analytes in which manual integration had been necessary may be recorded in a report case narrative specific to a particular client and project requirement.

Manual integrations which are not performed to Accutest's specifications are set aside for corrective action, which may include analyst retraining or further investigation as necessary.

GALP Audit Trail Review. Good Automated Laboratory Practice (GALP) audits are comprehensive data package audits that include a review of raw data, process logbooks, processed data reports and GALP audit trails from individual instruments and LIMS. GALP audit trails, which record all electronic data activities, are available for the majority of computerized methodology and the laboratory information management system (LIMS). These audit trails are periodically reviewed to determine if interventions performed by technical staff constitute an appropriate action. The review is performed on a recently completed job and includes interviews with the staff who performed the analysis. Findings

indicative of inappropriate interventions or data integrity issues are investigated to determine the cause and the extent of the anomaly.

Confidential Reporting of Data Integrity Issues. Data integrity concerns may be raised by any individual to their supervisor. Employees with data integrity concerns should always discuss those concerns with their immediate supervisors as a first step unless the employee is concerned with the confidentiality of disclosing data integrity issues or is uncomfortable discussing the issue with their immediate supervisors. The supervisor makes an initial assessment of the situation to determine if the concern is related to a data integrity violation. Those issues that appear to be violations are documented by the supervisor and referred to the Director of Quality Assurance for investigation.

Documented procedures for the confidential reporting of data integrity issues in the laboratory are part of the data integrity policy. These procedures assure that laboratory staff can privately discuss ethical issues or report items of ethical concern without fears of repercussions with senior staff.

Employees with data integrity concerns that they consider to be confidential are directed to the Corporate Human Resources Manager in Dayton, New Jersey. The HR Manager acts as a conduit to arrange a private discussion between the employee and the Corporate QA Director or a local QA Officer.

During the employee - QA discussion, the QA representative evaluates the situation presented by the employee to determine if the issue is a data integrity concern or a legitimate practice. If the practice is legitimate, the QA representative clarifies the process for the employee to assure understanding. If the situation appears to be a data integrity concern, the QA representative initiates a Data Integrity Investigation following the procedures specified in SOP EQA059.

Data Integrity Investigations. Follow-up investigations are conducted for all reported instances of ethical concern related to data integrity. Investigations are performed in a confidential manner by senior management according to a documented procedure. The outcome of the investigation is documented and reported to the company president who has the ultimate responsibility for determining the final course of action in the matter. Investigation documentation includes corrective action records, client notification information and disciplinary action outcomes, which is archived for a period of five years.

The investigations are conducted by the senior staff and supervisory personnel from the affected area. The investigations team includes the Laboratory Director and the Quality Assurance Director. Investigations are conducted in a confidential manner until it is completed and resolved.

The investigation includes a review of the primary information in question by the investigations team. The team performs a review of associated data and similar historical data to determine if patterns exist. Interviews are conducted with key staff to determine the reasons for the observed practices.

Following data compilation, the investigations team reviews all information to formulate a consensus conclusion. The investigation results are documented along with the recommended course of action.

Corrective Action, Client Notification & Discipline. Investigations that reveal systematic data integrity issues will be referred for corrective action, resolution and disposition (Section 13). If the investigation indicates that an impact to data has occurred and the defective data has been released to clients, client notification procedures will be initiated following the steps in Section 17.6.

In all cases of data integrity violations, some level of disciplinary action will be conducted on the responsible individual. The level of discipline will be consistent with the violation and may range from retraining and/or verbal reprimand to termination. A zero tolerance policy is in effect for unethical actions.

4.0 JOB DESCRIPTIONS OF KEY STAFF

4.1 ***Requirement***: Descriptions of key positions within the organization are defined to ensure that clients and staff understand duties and the responsibilities of the management staff and the reporting relationships between positions.

President/Chief Executive Officer. Responsible for all laboratory operations and business activities. Establishes the company mission and objectives in response to business needs. Direct supervision of the Vice President of Operations, each laboratory director, client services, management information systems, quality assurance and health and safety.

Vice President, Operations/Laboratory Director. Reports to the company president. Establishes laboratory operations strategy. Direct supervision of organic chemistry, inorganic chemistry, field services, and sample management. Maintains operational responsibility for the designated regional laboratories as defined in the Accutest Laboratories Organization Chart. Mid-Atlantic Vice President Operations assumes the responsibilities of the CEO in his absence.

Vice President, Chief Information Officer. Reports to the company president. Develops the IT software and hardware agenda. Provides system strategies to compliment company objectives. Maintains all software and hardware used for data handling.

Director, Quality Assurance. Reports to the company president and functions independently from laboratory operations. Establishes the company quality agenda, develops quality procedures, provides assistance to operations on quality procedure implementation, coordinates all quality control activities, monitors the quality system, provides quality system feedback to management to be used for process improvement and oversees health and safety. Assumes the responsibilities of the CEO in the absence of the CEO and the Vice President Operations.

Director Client Services. Reports to the company president. Establishes and maintains communications between clients and the laboratory pertaining to client requirements which are related to sample analysis and data deliverables. Initiates client orders and supervises sample login operations.

Manager, Organics (Organics Technical Director). Reports to the laboratory director. Directs the operations of the organics group, consisting of organics preparation and instrumental analysis. Establishes daily work schedule. Supervises method implementation, application, and data production. Responsible for following Quality System requirements. Maintains laboratory instrumentation in an operable condition. Assumes the responsibilities of the Vice President Operations in his absence.

Manager, Inorganics (Inorganics Technical Director). Reports to the laboratory director. Directs the operations of the inorganics group, consisting of wet chemistry and the metals laboratories. Establishes daily work schedule. Supervises method implementation, application, and data production. Responsible for following Quality System requirements. Maintains laboratory instrumentation in an operable condition. Assumes the responsibilities of the Vice President Operations in his absence.

Manager, Field Services. Reports to the laboratory director. Conducts field sampling and analysis of "analyze immediately" parameters in support of ongoing field projects. Responsible for proper collection, preservation, documentation and shipment of field samples. Maintains field sampling and field instrumentation required to perform primary responsibilities.

Manager, Sample Management. Reports to the laboratory director. Develops, maintains and executes all procedures required for receipt of samples, verification of preservation, and chain of custody documentation. Responsible for maintaining and documenting secure storage, delivery of samples to laboratory units on request and courier services.

Health & Safety Officer. Reports to the Vice President Operations and Quality Assurance Director. Responsible for developing company safety program and chemical hygiene plan. Reviews and updates these plans annually. Responsible for employee training on relevant health and safety topics. Documents employee training. Manages laboratory waste management program.

Supervisor, Wet Chemistry. Reports to the inorganics manager. Executes daily analysis schedule. Supervises the analysis of samples for wet chemistry parameters using valid, documented methodology. Maintains instrumentation in an operable condition. Reviews data for compliance to quality and methodological requirements. Assumes the responsibilities of the Inorganics Manager in his absence.

Supervisor, Metals. Reports to the inorganics manager. Executes daily analysis schedule. Supervises the analysis of samples for metallic elements using valid, documented methodology. Documents all procedures and data production activities. Maintains instrumentation in an operable condition. Reviews data for compliance to quality and methodological requirements.

Supervisor, Organic Preparation. Reports to the organics manager. Executes the daily sample preparation schedule. Performs the extract of multi-media samples for organic constituents using valid, documented methodology. Prepares documentation for extracted samples. Assumes custody until transfer for analysis.

Technical Support Supervisor, Organics. Reports to the organic manager. Oversees all instrument maintenance and new equipment installation. Conducts method development and implementation tasks.

Assistant Manager, Organics. Reports to the organics manager. Expedites the analysis of samples and sample extracts. Executes daily analysis schedule. Supervises the analysis of samples for organic parameters using valid, documented methodology. Documents all data and data production activities. Maintains instrumentation in an operable condition. Reviews data for compliance to quality and methodological requirements. Assumes the responsibilities of the Organics Manager in his absence.

Supervisor, Report Generation. Reports to the organics manager. Compiles raw and processed sample data and assembles into client-ready reports. Initiates report scanning for archiving purposes. Maintains raw batch data in accessible storage. Mails completed reports to clients according to specified report turnaround schedule.

Quality Assurance Officers. Reports to the Director, Quality Assurance. Performs quality control data review for trend monitoring purposes. Conducts internal audits and prepares reports for management review. Oversees proficiency testing program. Process quality control data for statistical purposes. Assumes the responsibilities of the Quality Assurance Director in his absence.

4.2 ***Employee Screening, Orientation, and Training***:

All potential laboratory employees are screened and interviewed by human resources and technical staff prior to their hire. The pre-screen process includes a review of their qualifications including education, training and work experience to verify that they have adequate skills to perform the tasks of the job.

Newly hired employees receive orientation training beginning the first day of employment by the Company. Orientation training consists of initial health and safety training including general laboratory safety, personal protection and building evacuation. Orientation also includes quality assurance program training, data integrity training, and an overview of the Company's goals, objectives, mission, and vision.

All technical staff receives training to develop and demonstrate proficiency for the methods they perform. New analysts work under supervision until the supervisory staff is satisfied that a thorough understanding of the method is apparent and method proficiency has been demonstrated, through a precision and accuracy study that has been documented, reviewed and approved by the QA Staff. Data from the study is compared to method acceptance limits. If the data is unacceptable, additional training is required. The analyst may also demonstrate proficiency by producing acceptable data through the analysis of an independently prepared proficiency sample.

Individual proficiency is demonstrated annually for each method performed. Data from initial and continuing proficiency demonstrations are archived in the individual's training folder.

4.3 ***Training Documentation***. The human resources department prepares a training file for every new employee. All information related to qualifications, experience, external training

courses, and education are placed into the file. Verification documentation for orientation, health & safety, quality assurance, and ethics training is also included in the file.

Additional training documentation is added to the file as it is developed. This includes documentation of SOP understanding, data for initial and continuing demonstrations of proficiency, performance evaluation study data and notes and attendance lists from group training sessions.

The Quality Assurance Department maintains the employee training database. This database is a comprehensive inventory of training documentation for each individual employee. The database enables supervisors to obtain current status information on training data for individual employees on a job specific basis. It also enables the management staff to identify training documentation in need of completion.

Employee specific database records are created by human resources on the date of hire. Data base fields for job specific requirements such as SOP documentation of understanding and annual demonstration of analytical capability are automatically generated when the supervisor assigns a job responsibility. Employees acknowledge that their SOP responsibilities have been satisfied using a secure electronic process which updates the database record. Reports are produced which summarize the qualifications of individual employees or departments.

5.0 SIGNATORY APPROVALS

Requirement: Procedures have been developed for establishing the traceability of data and documents. The procedure consists of a signature hierarchy, indicating levels of authorization for signature approvals of data and information within the organization. Signature authority is granted for approval of specific actions based on positional hierarchy within the organization and knowledge of the operation that requires signature approval. A log of signatures and initials of all employees is maintained by the HR Staff for cross-referencing purposes.

5.1 *Signature Hierarchy*.

President/Chief Executive Officer. Authorization for contracts and binding agreements with outside parties. Approval of final reports, quality assurance policy, SOPs, project specific QAPs, data review and approval in lieu of technical managers. Note: Contract signature authority resides with Company officers only, which include the President/CEO, Chief Financial Officer and Vice President Administration.

Vice President, Operations/Laboratory Director. Approval of final reports and quality assurance policy in the absence of the President. Approval of SOPs, project specific QAPs, data review and approval in lieu of technical managers. Establishes and implements technical policy.

Vice President, Chief Information Officer. Department specific supplies purchase. MIS policy.

Director, Quality Assurance. Approval of final reports and quality assurance policy in the absence of the President. Approval of SOPs, project specific QAPs, data review and approval in lieu of technical managers.

Director, Client Services. QAP and sampling and analysis plan approval. Project specific contracts, pricing, and price modification agreements. Approval and acceptance of incoming work, Client services policy.

Managers, Technical Departments. Methodology and department specific QAPs. Data review and approval, department specific supplies purchase. Technical approval of SOPs.

Manager, Sample Management. Initiation of laboratory sample custody and acceptance of all samples. Approval of department policies and procedures. Department specific supplies purchase.

Manager, Health & Safety. Approval of health and safety policy in the absence of the President and QA Director. Approval of health and safety SOPs. Waste manifesting and approval.

Assistant Managers: Technical Departments. Data review approval, purchasing of expendable supplies.

Supervisor, Field Services. Sampling plan design and approval. Data review for field parameters. State form certification. Department policies and procedures. Department specific supplies purchase.

Supervisors, Technical Departments. Data review approval, purchasing of expendable supplies.

5.2 ***Signature Requirements.*** All laboratory activities related to sample custody and generation or release of data must be approved using either initials, signatures or electronic, password protected procedures. The individual, who applies his signature initial or password to an activity or document, is authorized to do so within the limits assigned to them by their supervisor. All written signatures and initials must be applied in a readable format that can be cross-referenced to the signatures and initials log if necessary.

5.3 ***Signature and Initials Log.*** The HR group maintains a signature and initials log. New employee signatures and initials are appended to the log on the first day of employment. Signature of individuals no longer employed by the company are retained, but annotated with their date of termination.

6.0 DOCUMENTATION & DOCUMENT CONTROL

Requirement: Document control policies have been established which specify that any document used as an information source or for recording analytical or quality control information must be managed using defined document control procedures. Accordingly, policies and procedures required for the control, protection, and storage of any information related to the production of analytical data and the operation of the quality system to assure its integrity and traceability have been established and implemented in the laboratory. The system contains sufficient controls for managing, archiving and reconstructing all process steps which contributed to the generation of an analytical test result. Using this system, an audit trail for reported data can be produced, establishing complete traceability for the result.

6.1 ***Administrative Records***. Administrative (non-analytical) records are managed by the quality assurance department. These records consist of electronic documents which are retained in a limited access electronic directory or paper documents, which are released to the technical staff upon specific request.

Form Generation, Modification & Control. The quality assurance group approves and manages all forms used as either stand-alone documents or in logbooks to ensure their traceability. Forms are generated as computer files only and are maintained in a limited access master directory. The QA staff also manages and approves modifications to existing forms. Obsolete editions of modified forms are retained for seven years.

Approved forms are assigned a 5-character alphanumeric code. The first two alpha characters designate the department that uses the form; the next three digits are sequentially assigned number.

New forms must include the name Accutest Laboratories and appropriate spaces for signatures of approval and dates. Further design specifications are the responsibility of the originating department.

The technical staff is required to complete all forms to the maximum extent possible. If information for a specific item is unavailable, the analyst is required to "Z" the information block. The staff is also required to "Z" the uncompleted portions of a logbook or logbook form if the day's analysis does not fill the entire page of the form.

Logbook Control. All laboratory logbooks are controlled documents that are comprised of approved forms used to document specific processes. New logs are numbered and issued to a specific individual who is assigned responsibility for the log. Old logs are returned to QA for entry into the document archive system where they are retained for seven (7) years. Laboratory staff may hold a maximum of two consecutively dated logbooks of the same type in the laboratory including the most recently issued book to simplify review of recently completed analysis.

Controlled Documents. Key laboratory documents that are distributed internally and externally are numbered for tracking purposes. Individuals receiving documents, who must be

informed when changes occur, receive controlled copies of those documents. Controlled status simplifies document updates and retrieval of outdated documents. Control is maintained through a document numbering procedure and document control logbook which identifies the individual receiving the controlled document and the date of receipt. Key documents are also distributed as uncontrolled documents if the recipient does not require updated copies when changes occur. Key documents in uncontrolled status are numbered and tracked using the same procedures as controlled documents.

Quality Systems Manual (QSM). All QSMs are assigned a number prior to distribution. The number, date of distribution, and identity of the individual receiving the document are recorded in the document control logbook. The numbering system is restarted with each new volume, which corresponds to the annual revision of the QSM. Electronic versions are distributed as read only files that are password protected.

Standard Operating Procedures (SOPs). SOPs are maintained by pre-designating the numbers of official copies of documents that are placed into circulation within the laboratory. Official documents are copied to green paper and placed into the appropriate laboratory section as follows:

Administrative: One master copy for the administrative file.

Sample Management: One controlled green copy for the sample management file.

Organics Laboratories: Two controlled green copies, one for the affected laboratory area, and one for the organics laboratory file.

Inorganics Laboratories: Two controlled green copies, one for the affected laboratory area, and one for the inorganics laboratory file.

Field Services: One controlled green copy for each field sampling team (generally a single field technician).

The original, signed copy of the SOP is maintained in the master SOP binder by the QA staff. The QA staff collects outdated versions of SOPs as they are replaced and archived for a period of seven (7) years in the QA archives. Electronic versions of outdated SOPs are moved from the active SOP directory to the inactive directory.

6.2 ***Technical Records.*** All records related to the analysis of samples and the production of an analytical result are archived in secure document storage or on electronic media and contain sufficient detail to produce an audit trail which re-creates the analytical result. These records include information related to the original client request, bottle order, sample login and custody, storage, sample preparation, analysis, data review and data reporting.

Each department involved in this process maintains controlled documents which enable them to maintain records of critical information relevant to their department's process.

6.3 ***Quality Control Support Data & Records***. All information and data related to the quality system is stored in a restricted access directory on the network server. Information on this directory is backed-up daily. Users of the quality assurance information and data have "read-only" access to the files contained in the directory. The QA staff and the laboratory director have write capability in this directory.

This directory contains all current and archived quality system manuals, SOPs, control limits, MDL studies, precision and accuracy data, official forms, internal audit reports, proficiency test scores and metrics calibration information.

The following information is retained in the directory:

Quality System Manuals
Standard Operating Procedures
ASTM & NIST Methods
Bottleware & Preservative QC Data
Certification Documentation
Change Management Data
External Audit Reports
Internal Audit Reports
Corrective Action Database
Laboratory Forms Directory
Health & Safety Manuals
Inactive Standard Operating Procedures
Method Detection Limit Data
Metrics Inventory & Calibration Data
Microbiology Reagent Data
Performance Limits
Proficiency Test Scores & Statistics
Project Specific Analytical Requirements
QC Report Reviews
Regulatory Agency Quality Documents
Staff Bios And Job Descriptions
State Specific Methods

6.4 ***Analytical Records***. All data related to the analysis of field samples are retained as either paper or electronic records that can be retrieved to compile a traceable audit trail for any reported result. All information is linked to the client job and sample number, which serves as a reference for all sample related information tracking.

Critical times in the life of the sample from collection through analysis to disposal are documented. This includes date and time of collection, receipt by the laboratory, preparation times and dates, analysis times and dates and data reporting information. Analysis times are calculated in hours for methods where holding time is specified in hours (≤72 hours).

Sample preparation information is recorded in a separate controlled logbook. It includes sample identification numbers, types of analysis, preparation and cleanup methods, sample weights and volumes, reagent lot numbers and volumes and any other information pertinent to the preparation procedure.

Information related to the identification of the instrument used for analysis is permanently attached to the electronic record. The record includes an electronic data file that indicates all instrument conditions employed for the analysis, including the type of analysis conducted. The analyst's identification is electronically attached to the record. The instrument tuning and calibration data is electronically linked to the sample or linked though paper logs which were used in the documentation of the analysis. Quality control and performance criteria are permanently linked to the paper archive or electronic file.

Paper records for the identity, receipt, preparation and evaluation of all standards and reagents used in the analysis are documented in prepared records and maintained in controlled documents or files. Lot number information linking these materials to the analysis performed is recorded in the logbooks associated with the samples in which they were used.

Manual calculations or peak integrations that were performed during the data review are retained as paper or scanned documents and included as part of the electronic archive. Signatures for data review are retained on paper or as scanned versions of the paper record for the permanent electronic file.

6.5 ***Confidential Business Information (CBI).*** Operational documents including SOPs, Quality Manuals, personnel information, internal operations statistics, and laboratory audit reports are considered confidential business information. Strict controls are placed on the release of this information to outside parties.

Release of CBI to outside parties or organizations may be authorized upon execution of a confidentiality agreement between Accutest and the receiving organization or individual. CBI information release is authorized for third party auditors and commercial clients in electronic mode as Adobe Acrobat .PDF format only.

6.6 ***Software Change Documentation & Control.*** Changes to software are documented as text within the code of the program undergoing change. Documentation includes a description of the change, reason for change and the date the change was placed into effect. Documentation indicating the adequacy of the change is prepared following the evaluation by the user who requested the change.

6.7 ***Report and Data Archiving.*** Accutest Laboratories produces digital files of all raw and processed data which is maintained for a minimum period of seven (7) years. The archived files consist of all raw data files and source documents associated with the analysis of field samples and proficiency test samples. Data files and source documents associated with method calibration and project and method quality control are also archived. After seven years, the files may be discarded unless contractual arrangements exist which dictate different requirements. Client or regulatory agency specific data retention practices are employed for several government organizations such as the Department of Defense and the Massachusetts Department of Environmental Protection that require a retention period of ten (10) years. Data archiving may also be extended up to ten (10) years for specific commercial clients in response to contractual requirements.

Complete date and time stamped PDF reports are generated automatically from the laboratory information management system (LIMS) using the source documents archived on the document server. These source documents are maintained on a document server and archived to primary and clone tapes. The primary tapes remain on premises while the clone tapes are taken to a secure offsite location for permanent storage. Both the primary and clone tapes remain in storage for the remainder of the archive period.

6.8 ***Training***. The company maintains a training record for all employees that documents that they have received instruction on administrative and technical tasks that are required for the job they perform. Training records for individuals employed by the company are retained for a period of six months following their termination of employment.

Training File Origination. The Human Resources Group (HR) initiates training files. The QA staff, through the Assistant Quality Assurance officer, retains the responsibility for the maintenance and tracking of all training related documentation in the file. The file is begun on the first day of employment. Information required for the file includes a copy of the individual's most current resume, detailing work experience and a copy of any college diplomas and transcript(s). Information added on the first day includes documentation of health and safety training, quality assurance training and a signed data integrity training and ethical conduct agreement.

Training documentation, training requirements, analyst proficiency information and other training related support documentation is tracked using a customized database application (Section 4.3). Database extracts provide an itemized listing of specific training requirements by job function. Training status summaries for individual analysts portray dates of completion for job specific training requirements.

6.9 ***Technical Training***. The supervisor of each new employee is responsible for developing a training plan for each new employee. The supervisor evaluates the employees training progress at regular frequencies. Supporting documentation, including demonstration of capability and precision and accuracy studies, which demonstrate an analyst's proficiency for a specific test, are added to the training file as completed. Employees and supervisors verify documentation of understanding (DOU) for all assigned standard operating procedures in the training database. Certificates or diplomas for any off-site training are also added to the file.

7.0 REFERENCE STANDARD TRACEABILITY

Requirement: Documented procedures, which establish traceability between any measured value and a national reference standard, are established by the laboratory as required. All metric measurements are traceable to NIST reference weights or thermometers that are calibrated on a regular schedule. All chemicals used for calibration of a quantitative process are traceable to an NIST reference that is documented by the vendor using a certificate of traceability. The laboratory maintains a documentation system that establishes the traceability links. The procedures for verifying and documenting traceability are documented in standard operating procedures.

7.1 ***Traceability of Metric Measurements - Thermometers***. Accutest uses NIST thermometers to calibrate commercially purchased thermometers prior to their use in the laboratory and annually thereafter for liquid in glass thermometers or quarterly for electronic temperature measuring devices. If necessary, thermometers are assigned correction factors that are determined during their calibration using an NIST thermometer as the standard. The correction factor is documented in a thermometer calibration database and on a tag attached to the thermometer. The correction factor is applied to temperature measurements before recording the measurement in the temperature log. Calibration of each thermometer is verified and documented on a regular schedule. The NIST thermometer is checked for accuracy by an ISO 17025 approved vendor every five (5) years following the specifications for NIST thermometer calibration verification detailed in the united States Environmental Protection Agency's "Manual for the Certification of Laboratories Analyzing Drinking Water", Fifth Edition, January 2005.

7.2 ***Traceability of Metric Measurements – Calibration Weights***. Accutest uses calibrated weights, which are traceable to NIST standard weights to calibrate all balances used in the laboratory. Balances are calibrated to specific tolerances within the intended use range of the balance. Calibration checks are required on each day of use. If the tolerance criteria are not achieved, corrective action specified in the balance calibration SOP is applied before the balance can be used for laboratory measurements. Recalibration of all calibration weights is conducted and documented on a biannual basis.

7.3 ***Traceability of Chemical Standards***. All chemicals, with the exception of bulk dry chemicals and acids, purchased as reference standards for use in method calibration must establish traceability to NIST referenced material through a traceability certificate. Process links are established that enable a calibration standard solution to be traced to its NIST reference certificate.
Chemical standards used for analysis must meet the purity specifications of the method. These specifications must be stated in the reagents section of the method SOP.

7.4 ***Assignment of Reagent, Bulk Chemical and Standard Expiration Dates.*** Expiration date information for all purchased standards, prepared standard solutions and selected reagents is provided to Accutest by the vendor as a condition of purchase. Neat materials, bulk chemicals including solvents, acids and inorganic reagents are not required to be purchased with expiration dates. An expiration date of five (5) years from the date of receipt shall be established. Prepared solutions are labeled with the expiration date provided by the

manufacturer. In-house prepared solutions are assigned expiration dates that are consistent with the method that employs their use unless documented experience indicates that an alternate date can be applied. If alternate expiration dates are employed, their use is documented in the method SOP. Expiration dates for prepared inorganic reagents, which have not exhibited instability, are established at two years from the date of preparation for tracking purposes.

The earliest expiration date has been established as the limiting date for assigning expiration dates to prepared solutions. The assignment of expiration dates that are later than the expiration date of any derivative solution or material are prohibited.

7.5 ***Documentation of Traceability***. Traceability information is documented in individual logbooks designated for specific measurement processes. The quality assurance group maintains calibration documentation for metric references in separate logbooks.

Balance calibration verification is documented in logbooks that are assigned to each balance. The individual conducting the calibration is required to initial and date all calibration activities. Any defects that occur during calibration are also documented along with the corrective action applied and a demonstration of return to control. Annual service reports and certificates are retained on file by the QA staff.

Temperature control is documented in logbooks assigned to the equipment being monitored. A calibrated thermometer is assigned to each individual item. Uncorrected and corrected measurements are recorded along with date and initials of the individual conducting the measurement on a daily or as used basis. Corrective action, if required, is also documented including the demonstration of return to control.

Initial traceability of chemical standards is documented via a vendor-supplied certificate (not available for bulk dry chemicals and acids) that includes lot number, expiration date and certified concentration information. Solutions prepared using the vendor supplied chemical standards are documented in logbooks assigned to specific analytical processes. Alternatively, documentation may be entered into the electronic standards and reagent tracking log. The documentation includes links to the vendor's lot number, an internal lot number, dates of preparation, expiration date, and the preparer's initials.
Accutest employs commercially prepared standard solutions whose traceability can be demonstrated through a vendor supplied certificate of analysis that includes an experimental verification of the standard's true concentration. The test value for the verification analysis must agree within 1% of the vendor's true value before it can be employed for calibration purposes. If the test value differs from the nominal value by more than 1%, then the test value is used as the true value in laboratory calibrations and calculations. Purchased standards which do not have a certificate of analysis cannot be used for calibration or calibration verification purposes and are rejected or returned to the vendor.

Supervisors conduct regular reviews of logbooks, which are verified using a signature and date.

8.0 TEST PROCEDURES, METHOD REFERENCES, AND REGULATORY PROGRAMS

Requirements: The laboratory employs client specified or regulatory agency approved methods for the analysis of environmental samples. A list of active methods is maintained, which specifies the type of analyses performed and cross-references the methods to applicable environmental regulations. Routine procedures used by the laboratory for the execution of a method are documented in standard operating procedures. Method performance and sensitivity are demonstrated annually where required. Defined procedures for the use of method sensitivity limits for data reporting purposes are established by the Director of Quality Assurance and used consistently for all data reporting purposes.

8.1 ***Method Selection & Application***. Accutest employs methods for environmental sample analysis that are consistent with the client's application, which are appropriate and applicable to the project objectives. Accutest informs the client if the method proposed is inappropriate or outdated and suggests alternative approaches.

Accutest employs documented, validated regulatory methods in the absence of a client specification and informs the client of the method selected. These methods are available to the client and other parties as determined by the client. Documented and validated in-house methods may be applied if they are appropriate to the project. The client is informed of the method selection.

8.2 ***Standard Operating Procedures***. Standard operating procedures (SOP) are prepared for routine methods executed by the laboratory, processes related to laboratory operations and sample or data handling. All SOPs are formatted to meet the specifications established by the National Environmental Laboratory Accreditation Conference, which are detailed in Chapter Five – Quality Systems of the established Standards. The procedures describe the process steps in sufficient detail to enable an individual, who is unfamiliar with the procedure to execute it successfully.

SOPs are evaluated annually and edited if necessary. Reviewed SOPs that do not require modification include an evaluation summary form indicating that an evaluation was conducted and modifications were not needed. SOPs can be edited on a more frequent basis if changes are required for any reason. These may include a change to the methodology, elimination of systematic errors that dictate a need for process changes or modifications to incorporate a new version of the method promulgated by the originating regulatory agency. Procedural modifications are indicted using a revision number. SOPs are available for client review at the Accutest facility upon request.

The complete list of the laboratories SOPs available as of the date of publication of this QSM version are detailed in Appendix II.

8.3 ***Method Validation***. Standard methods from regulatory sources are primarily used for all analysis. Standard methods do not require validation by the laboratory. Non-standard, in-house methods are validated prior to use. Validation is also performed for standard methods

applied outside their intended scope of use. Validation is dependent upon the method application and may include analysis of quality control samples to develop precision and accuracy information for the intended use. A final method validation report is generated, which includes all data in the validation study. A statement of adequacy and/or equivalency is included in the report. A copy of the report is archived in the quality assurance directory of the company server.

Non-standard methods are validated prior to use. This includes the validation of modified standard methods to demonstrate comparability with existing methods. Demonstrations and validations are performed and documented prior to incorporating technological enhancements and non standard methods into existing laboratory methods used for general applications. The demonstration includes method specific requirements for assuring that significant performance differences do not occur when the enhancement is incorporated into the method. Validation is dependent upon method application and may include the analysis of quality control samples to develop precision and accuracy information for intended use.

The study procedures and specifications for demonstrating validation include comparable method sensitivity, calibration response, method precision, method accuracy and field sample consistency for several classes of analytical methods are detailed in this document. These procedures and specifications may vary depending upon the method and the modification.

8.4 ***Estimated Uncertainty.*** A statement of the estimated uncertainty of an analytical measurement accompanies the test result when required. Estimated uncertainty is derived from the performance limits established for spiked samples of similar matrices. The degree of uncertainty is derived from the negative or positive bias for spiked samples accompanying a specific parameter. When the uncertainty estimate is applied to a measured value, the possible quantitative range for that specific parameter at that measured concentration is defined. Well recognized regulatory methods that specify values for the major sources of uncertainty and specify the data reporting format do not require a further estimate of uncertainty.

8.5 ***Demonstration of Capability.*** Confirmation testing is conducted to demonstrate that the laboratory is capable of performing the method before its application to the analysis of environmental samples. The results of the demonstration tests are compared to the quality control specifications of the method to determine if the performance is acceptable.

Capability demonstrations are conducted initially for each method on every instrument and annually on a method specific basis thereafter. Acceptable demonstrations are documented for individual training files and retained by the QA staff. New analytes, which are added to the list of analytes for an accredited method, are evaluated for applicability through a demonstration of capability similar to those performed for accredited analytes.

8.6 ***Method Detection Limit Determination.*** Annual method detection limit (MDL) studies are performed as appropriate for routine methods used in the laboratory. MDL studies are also performed when there is a change to the method that affects how the method is performed or when an instrumentation change that impacts sensitivity occurs. The procedure used for determining MDLs is described in 40 CFR, Part 136, Appendix B. Studies are performed for each method on water, soil and air matrices for every instrument that is used to perform the

method. MDLs are established at the instrument level. The highest MDL of the pooled instrument data is used to establish a laboratory MDL. MDLs are experimentally verified through the analysis of spiked quality control samples at 2-4 times the concentration of the experimental MDL. The verification is performed on every instrument used to perform the analysis. The quality assurance staff manages the annual MDL determination process and is responsible for retaining MDL data on file. Approved MDLs are appended to the LIMS and used for data reporting purposes.

8.7 ***Limit of Detection (LOD).*** For the DoD ELAP the limit of detection (LOD) for each method and target analyte of concern is established for each instrument that is used to perform the method. The LOD is established by spiking a water and/or soil matrix at approximately two to three times the calculated MDL (for a single-analyte standard) or one to four times the calculated MDL (for a multi-analyte standard). The LOD undergoes all sample processing steps and is validated by the qualitative identification of the analytes of interest. The spike concentration establishes the LOD and must be verified quarterly.

8.8 ***Instrument Detection Limit Determination***. Instrument detection limits (IDLs) are determined for all inductively coupled argon plasma emission spectrophotometers and mass spectrometers. The IDL is determined for the wavelength (emission) of each element and the ion (mass spectrometry) of each element used for sample analysis. The IDL data is used to estimate instrument sensitivity in the absence of the sample matrix. IDL determinations are conducted at the frequency specified in the appropriate SOPs' for ICP and ICP/MS analysis.

8.9 ***Method Reporting Limit.*** The method reporting limit for organic methods is determined by the concentration of the lowest calibration standard in the calibration curve. This value is adjusted based on several sample preparation factors including sample volume, moisture content (soils), digestion, distillation or dilution. The low calibration standard is selected by department managers as the lowest concentration standard that can be used for calibration while continuing to meet the calibration linearity criteria of the method being used. The validity of the method reporting limits are confirmed through the analysis of a spiked quality control sample at the method reporting limit concentration. By definition, detected analytes at concentrations below the low calibration standard cannot be accurately quantitated and are qualified as estimated values.

The reporting limit for inorganics methods is defined as the concentration which is greater than the MDL where method quality control criteria has been achieved. The reporting limit for general chemistry methods employing multiple point calibrations must be greater than or equal to the concentration of the lowest standard of the calibration range.

The reporting limit established for both organic and inorganic analysis is above the calculated method detection limit where applicable.

8.10 ***Limit of Quantitation (LOQ).*** For the DoD ELAP the limit of quantitation (LOQ) for each analyte of concern is determined. The LOQ is set within the range of calibration is greater than the established LOD. Precision and bias criteria for the LOQ are established to meet client requirements and are verified quarterly.

8.11 ***Reporting of Quantitative Data.*** Analytical data for all methods is reported without qualification to the reporting limit established for each method. Data, for organic methods may be reported to the established method detection limit depending upon the client's requirements provided that all qualitative identification criteria for the detected parameter have been satisfied. All parameters reported at concentrations between the reporting limit and the method detection limit are qualified as estimated.

Data for inorganic methods are reported to the established method reporting limits. Inorganic data for specific methods may also be reported to the established method detection limit at client request. However, this data is always qualified as estimated.

Measured concentrations of detected analytes that exceed the upper limit of the calibration range are either diluted into the range and reanalyzed or qualified as an estimated value. The only exception to this applies to ICP and ICP/MS analysis, which can be reported to the upper limit of the experimentally determined linear range without qualification.

8.12 ***Precision and Accuracy Studies.*** Annual precision and accuracy (P&A) studies, which demonstrate the laboratories ability to generate acceptable data, are performed for all routine methods used in the laboratory. The procedure used for generating organic P&A data is referenced in the majority of the regulatory methodology in use. The procedure requires quadruplicate analysis of a sample spiked with target analytes at a concentration in the working range of the method. This data may be compiled from a series of existing blank spikes or laboratory control samples. Accuracy (percent recovery) of the replicate analysis is averaged and compared to established method performance limits. Values within method limits indicate an acceptable performance demonstration. Precision and accuracy date is also used to annually demonstrate analytical capability for individual analysts. Annual demonstration of capability data is archived in individual training files.

8.13 ***Method Sources & References.*** The Quality Assurance Staff maintains a list of active methods used for the analysis of samples. This list includes valid method references from sources such as USEPA, ASTM or Standard Methods designations and the current version and version date.

Updated versions of approved reference methodology are placed into use as changes occur. The Quality Assurance Director informs operations management of changes in method versions as they occur. The operations management staff selects an implementation date. The operations staff is responsible for completing all method use requirements prior to the implementation date. This includes modification of SOPs, completion of MDL and precision and accuracy studies and staff training. Documentation of these activities is provided to the QA staff who retains this information on file. The updated method is placed into service on the implementation date and the old version is de-activated.

Multiple versions of selected methods may remain in use to satisfy client specific needs. In these situations, the default method version becomes the most recent version. Client specific needs are communicated to the laboratory staff using method specific analytical method codes,

which clearly depict the version to be used. The old method version is maintained as an active method until the specified client no longer requires the use of the older version.

Accutest will not use methodology that represents significant departures from the reference method unless specifically directed by the client. If clients direct the laboratory to use a method modification that represents a significant departure from the reference method, the request will be documented in the project file.

8.14 ***Analytical Capabilities***. . Appendix III provides a detailed listing of the methodology employed for the analysis of test samples.

9.0 SAMPLING, SAMPLE MANAGEMENT, LOGIN, CUSTODY, STORAGE AND DISPOSAL

Requirement: The laboratory must employ a system which ensures that client supplied product or supplied product (the sample) is adequately evaluated, acknowledged, and secured upon delivery to the laboratory. The system also assures that product chain of custody is maintained and that sample receipt conditions and preservation status are documented and communicated to the client and internal staff. The login procedure assigns, documents, and maps the specifications for the analysis of each unique sample to assure that the requested analysis is performed on the correct sample and enables the sample to be tracked throughout the laboratory analytical cycle. The system includes procedures for reconciling defects in sample condition or client provided data, which are identified at sample arrival. The system specifies the procedures for proper sample storage, transfer to the laboratory, and disposal after analysis. The system is also documented in standard operating procedures.

9.1 ***Order Receipt and Entry***: New orders are initiated and processed by the client services group (See Chapter 14, Procedures for Executing Client Specifications). The new order procedure includes mechanisms for providing bottles to clients, which meet the size, cleanliness, and preservation specifications for the analysis to be performed.

For new orders, the project manager prepares a bottle request form, which is submitted to sample management. This form provides critical project details to the sample management staff, which are used to prepare and assemble the sample bottles for shipment to the client prior to sampling.

The bottle order is assembled using bottles that meet USEPA specifications for contaminant free sample containers. Accutest uses a combination of commercially supplied pre-cleaned bottles and bottles that have been tested for residual contamination and verified to meet USEPA specifications prior to use. Sterile bottles for microbiological samples are purchased from commercial sources.

Bottles, which are not purchased pre-cleaned, are checked to assure that they are free of contamination from targeted analytes before being released for use. Sterile bottles are checked for contamination with each lot. The QA staff retains a copy of the documentation of in-house contamination and sterility checks and maintains the responsibility for approving and releasing bottle lots for use following a review of the check data.

Preservative solutions that are specified for the analysis requested are dispensed into the sample bottle prior to shipment. All preservative solutions are prepared in the laboratory or purchased from commercial suppliers. Each solution is checked to assure that it is free of contamination from the compounds being analyzed before being released for use.

Reagent water for trip and field blanks is poured into appropriately labeled containers. All bottles are packed into ice chests with blank chain of custody forms and the original bottle order form. Completed bottle orders are delivered to clients using Accutest couriers or commercial carriers for use in field sample collection.

9.2 ***Sampling***. Documented procedures are employed by the field staff for field sample collection and are accessible during sample collection activities. Field activities are documented in controlled notebooks which detail relevant field conditions, site data and the results of field measurements. Appropriate custody procedures for collected samples are initiated by the field staff at the time of sample collection. Samples are documented, labeled and preserved according to the specifications of the method and/or regulatory program prior to being shipped to the laboratory.

9.3 ***Sample Receipt and Custody***. Samples are delivered to the laboratory using a variety of mechanisms including Accutest couriers, commercial shippers, and client self-delivery. Documented procedures are followed for arriving samples to assure that custody and integrity are maintained and handling/ preservation requirements are documented and maintained.

Sample custody documentation is initiated when the individual collecting the sample collects field samples. Custody documentation includes all information necessary to provide an unambiguous record of sample collection, sample identification, and sample collection chronology. Initial custody documentation employs either Accutest or client generated custody forms.

Accutest generates a chain of custody in situations where the individuals who collected the sample did not generate custody documentation in the field.

Accutest defines sample custody as follows:

∴ The sample is in the actual custody or possession of the assigned responsible person,

∴ The sample is in a secure area.

The Accutest facility is defined as a secure facility. Perimeter security has been established, which limits access to authorized individuals only. Visitors enter the facility through the building lobby and must register with the receptionist prior to entering controlled areas. While in the facility, visitors are required to wear a visitor's badge and must be accompanied by their hosts at all times. After hours, building access is controlled using a computerized passkey reader system. This system limits building access to individuals with a pre-assigned authorization status. After hours visitors are not authorized to be in the building. Clients delivering samples after hours must make advanced arrangements through client services and sample management to assure that staff is available to take delivery and maintain custody.

Upon arrival at Accutest, the sample custodian reviews the chain of custody for the samples received to verify that the information on the form corresponds with the samples delivered. This includes verification that all listed samples are present and properly labeled, checks to verify that samples were transported and received at the required temperature, verification that the sample was received in proper containers, verification that sufficient volume is available to conduct the requested analysis, and a check of individual sample containers to verify test specific preservation requirements including the absence of headspace for volatile compound analysis.

Sample conditions and other observations are documented on the chain of custody by the sample custodian prior to completing acceptance of custody and in an online database that creates a permanent record of all sample login activities. The sample custodian accepts sample custody upon verification that the custody document is correct. Discrepancies or non-compliant situations are documented and communicated to the Accutest project manager, who contacts the client for resolution. The resolution is documented and communicated to sample management for execution.

The sample management staff maintains an electronic sample receipt log. This log details all sample-related information in a searchable database that is updated upon data entry and backed up daily. The log records include critical date information, numbers of samples, numbers of bottles for each parameter, descriptions of bottles for each parameter, preservation conditions, bottle refrigerator location, and bottle conditions. Data entry into the log is secured using individual passwords.

During initial login, each bottle is assigned a unique number and is labeled with a barcode corresponding to that number. A bar-coding and scanning system electronically tracks sample custody transfers between individuals within the laboratory. Internal custody documentation may be required for compliance with regulatory agency or contractual specifications. A documented, chronological record of each sample transfer identifying each individual having possession of the sample is created in the laboratory information management system, which can be printed and included in data reports to demonstrate continuous custody.

9.4 ***Laboratory Preservation of Improperly Preserved Field Samples.*** Accutest will attempt to preserve field samples that were received without proper preservation to the extent that it is feasible and supported by the methods in use. Laboratory preservation of improperly preserved or handled field samples is routinely performed for metals samples. Special handling procedures may also be applied to improperly preserved volatile organics.

Aqueous metals samples that were not nitric acid preserved to pH 2 in the field are laboratory preserved and held for twenty (24) hours to equilibrate prior to analysis. Aqueous metals samples requiring field filtration may be filtered in the laboratory within seventy-two (72) hours of receipt provided that the sample has not been acid preserved.

Unpreserved volatile organics samples may be analyzed within seven (7) days to minimize degradation of volatile organics if the laboratory is notified in advance of the failure to preserve upon collection. Laboratory preservation of unpreserved aqueous samples is not possible. A pH check of volatile organic samples prior to analysis will compromise the sample by allowing volatile organics to escape during the check. If the laboratory is not notified of the failure to field preserve an aqueous volatile organic sample, the defect will not be identified until sample analysis has been completed and the data is qualified accordingly.

9.5 ***Sample Tracking Via Status Change.*** An automated, electronic LIMS procedure records sample exchange transactions between departments and changes in analytical status. This system tracks all preparation, analytical, and data reporting procedures to which a sample is subjected while in the possession of the laboratory. Each individual receiving samples must

acknowledge the change in custody and operational status in the LIMS. This step is required to maintain an accurate electronic record of sample status, dates of analytical activity, and custody throughout the laboratory.

Sample tracking is initiated at login where all chronological information related to sample collection dates and holding times are entered into the LIMS. This information is entered on an individual sample basis.

9.6 ***Sample Acceptance Policy***. Incoming samples must satisfy Accutest's sample acceptance criteria before being logged into the system. Sample acceptance is based on the premise that clients have exercised proper protocols for sample collection. This includes complete documentation, sufficient volume, proper chemical preservation, temperature preservation, sample container sealing and labeling, and appropriate shipping container packing.

The sample management staff will make every attempt to preserve improperly preserved samples upon arrival. However, if preservation is not possible, the samples may be refused unless the client authorizes analysis. No samples will be accepted if holding times have been exceeded or will be exceeded before analysis can take place unless the client authorizes analysis.

Sample acceptance criteria include proper custody and sample labeling documentation. Proper custody documentation includes an entry for all physical samples delivered to the laboratory with an identification code that matches the sample bottle and a date and signature of the individual who collected the sample and delivered them to the laboratory.

Accutest reserves the right to refuse any sample which in its sole and absolute discretion and judgment is hazardous, toxic and poses or may pose a health, safety or environmental risk during handling or processing. The company will not accept samples for analysis using methodology that is not performed by the laboratory or for methods that lab does not hold valid accreditations unless arrangements have been made to have the analysis conducted by a qualified subcontractor.

9.7 ***Assignment of Unique Sample Identification Codes***. Unique identification codes are assigned to each sample bottle to assure traceability and unambiguously identify the tests to be performed in the laboratory.

The sample identification coding process begins with the assignment of a unique alphanumeric job number. A job is defined as a group of samples received on the same day, from a specific client pertaining to a specific project. A job may consist of groups of samples received over a multi-day period. The first character of the job number is an alpha-character that identifies the laboratory facility. The next characters are numeric and sequence by one number with each new job.

Unique sample numbers are assigned to each bottle collected as a discrete entity from a designated sample point. This number begins with the job number and incorporates a second series of numbers beginning at one and continuing chronologically for each point of collection. The test

to be performed is clearly identified on the bottle label. Multiple sample bottles collected for analysis of the same parameter are numbered bottle 1, 2, … etc.

Alpha suffixes may be added to the sample number to identify special designations such as subcontracted tests, in-house QC checks, or re-logs. Multiple sample bottles for a specific analysis are labeled Bottle 1, Bottle 2, etc.

9.8 ***Subcontracted Analysis***. Subcontract laboratories are employed to perform analysis not performed by Accutest. The quality assurance staff evaluates subcontract laboratories to assure their quality processes meet the standards of the environmental laboratory industry prior to engagement. Throughout the subcontract process, Accutest follows established procedures to assure that sample custody is maintained and the data produced by the subcontractor meets established quality criteria.

Subcontracting Procedure. Subcontracting procedures are initiated through several mechanisms, which originate with sample management. Samples for analysis by a subcontractor are logged into the Accutest system using regular login procedures. If subcontract parameters are part of the project or sample management has received subcontracting instructions for a specific project, a copy of the chain of custody is given to the appropriate project manager with the subcontracted parameters highlighted. This procedure triggers the subcontract process at the project management level. The project manager contacts an approved subcontractor that carries accreditation in the venue of the project location to place the subcontract order. A subcontract order form (SOF) is simultaneously prepared in electronic format, by the project manager and filed with the original chain of custody. The SOF and the subcontract chain of custody are forwarded to sample management, via E-Mail, for processing. A copy is filed with the original CoC.

Sample management signs the subcontract chain of custody and ships the sample(s) to the subcontractor. The subcontract CoC is filed with the original CoC and the request for subcontract. Copies are distributed to the login department, the project manager, sample management and the client.

Clients are verbally notified of the need to subcontract analysis as soon as the need is identified by the client services staff. This may occur during the initial project setup or at the time of login if the project setup had not been initiated through the client services staff. Copies of the subcontract CoC and the original CoC, which are electronically distributed to clients, constitutes documented client notification of the laboratories intent to subcontract analysis.

Subcontractor data packages are reviewed by the QA Staff to assess completeness and quality compliance. If completeness defects are detected, the subcontractor is asked to immediately upgrade the data package. If data quality defects are detected, the QA staff retains the package for further review. The QA staff will pursue a corrective action solution before releasing defective data to the client.

Approved subcontract data is entered into the laboratory information management system (LIMS) if possible and incorporated into the final report. All subcontract data is footnoted to

provide the client with a clear indication of its source. Copies of original subcontract data are included in the data report depending on the reporting level specified by the client. Applicable subcontractor accreditation information is provided with the subcontractor data.

Subcontract Laboratory Evaluation. The QA staff evaluates subcontract laboratories prior to engagement. The subcontract laboratory must provide Accutest with proof of a valid certification to perform the requested analysis for the venue where they were collected and for a specific program should an approval or accreditation be required. In addition, the QA staff may require a copy of the laboratory's Quality Systems Manual, copies of SOPs used for the subcontracted analysis, a copy of the most recent performance evaluation study for the subcontracted parameter, copies of the internal data integrity policy and copies of the most recent regulatory agency or third party accreditor audit report. Certification verification must be submitted to Accutest annually. If possible, the QA staff may conduct a site visit to the laboratory to inspect the quality system. Accutest Laboratories assumes the responsibility for the performance of all subcontractors who have successfully demonstrated their qualifications and should obtain an example data deliverable package prior to initiation of subcontract work for compliance review. Qualification of a subcontract laboratory may be bypassed if the primary client directs Accutest to employ a specific subcontractor.

9.9 ***Sample Storage***. Following sample transfer to the sample custodian, samples are assigned to various secured, refrigerated storage areas depending upon the test to be performed and the matrix of the samples. The location (refrigerator and shelf) of each sample is recorded on the chain of custody adjacent to the line corresponding to each sample number and also entered into the LIMS. Samples remain in storage until the laboratory technician requests that they be transferred into the laboratory for analysis.

Second shift staff is authorized to retrieve samples from storage and initiate custody transfer. All sample request forms must be completed regardless of who performs the transfer.

Samples for volatile organics analysis are placed in storage in designated refrigerators by the sample custodian and immediately transferred to the organics group control. Sample custody is transferred to the department designee. These samples are segregated according to matrix to limit opportunities for cross contamination to occur.

Organics staff is authorized to retrieve samples from these storage areas for analysis. When analysis is complete, the samples are placed back into storage.

9.10 ***Sample Login***. Following sample custody transfer to the laboratory, the documentation that describes the clients analytical requirements are delivered to the sample login group for coding and entry to the Laboratory Information Management System (LIMS). This process translates all information related to collection time, turnaround time, sample analysis, and deliverables into a code which enables client requirements to be electronically distributed to the various departments within the laboratory for scheduling and execution.

The technical staff is alerted to client or project specific requirements through the use of a unique project code that is electronically attached to the job during login. The unique project

code directs the technical staff to controlled specifications documents detailing the unique requirements.

9.11 ***Sample Retrieval for Analysis.*** Individual laboratory departments prepare and submit written requests to the sample custodian to retrieve samples for analysis. The sample custodian retrieves all samples except volatile organics and delivers them to the requesting department. Retrieval priorities are established by the requesting department and submitted to the sample custodian when multiple requests are submitted. Internal custody transfers using the bar code scanning system occur whenever the samples change hands or locations.
After sample analysis has been completed, the department requests pick-up and return of the sample to the storage area. The sample custodian retrieves the sample and completes the custody transfer from the department of the transfer back to sample management or sample storage.

9.12 ***Sample Disposal.*** Accutest retains all samples and sample extracts under proper storage for a minimum of 30 days following completion of the analysis report. Longer storage periods are accommodated on a client specific basis if required. Samples may also be returned to the client for disposal.
Accutest disposes of all laboratory wastes following the requirements of the Resource Conservation and Recovery Act (RCRA). The Company has obtained and maintains a waste generator identification number, NJD982533622.

Sample management generates a sample disposal dump sheet from the LIMS tracking system each week, which lists all samples whose holding period has expired. Data from each sample is compared to the hazardous waste criteria established by the New Jersey Department of Environmental Protection (NJDEP).

Samples containing constituents at concentrations above the criteria are labeled as hazardous and segregated into four general waste categories for disposal as follows:

- Waste Oil
- Soil (solids – positive and negative hazardous characteristics)
- Mixed Aqueous
- Sludges (semi-solids)
- PCB Hazardous Waste (USEPA 40 CFR 761 criteria).

Non-hazardous aqueous samples are diluted and disposed directly into the laboratory sink. All aqueous liquids pass through a neutralization system before entering the municipal system. Solid samples are emptied into consolidation drums and disposed as hazardous waste or non-hazardous wastes depending upon the results of hazardous characteristics determination. Samples classified as PCB hazardous wastes are labeled and packaged according to the requirements in 40 CFR 761.

Empty glass and plastic bottles from aqueous and solid samples are segregated for recycling. Recycled materials are collected by a commercial contractor and transferred to a county

transfer facility for separation into various materials categories. These operations are classified as secure facilities employing cameras, security guards and fiber optic security systems. The recyclable material is transported to a recycling facility for further processing. Separated glass is transported to a processing facility where it is acid washed in two, separate wash baths, rinsed in boiling water and ground into ½ inch chunks. The chunks are transported to an end product user for re-manufacturing into a glass product.

Separated plastic is transported to a processing facility where it is acid washed to remove the labels and adhesives and boiled for sterilization. The sample containers and any remaining labels are shredded and ground resulting in complete destruction of remaining labels the ground material is sent by rail car or tractor-trailer to various end users that melt and reform the material into useful products of their industry. The recycling facility employs a Code of Ethics in which all client names are confidential and are not divulged to any individual or corporation without written permission from the client.

Laboratory wastes are collected by waste stream in designated areas throughout the laboratory. Waste streams are consolidated twice each week by the waste custodian and transferred to stream specific drums for disposal through a permitted waste management contractor. Filled, consolidated drums are tested for hazardous characteristics and scheduled for removal from the facility for appropriate disposal based on the laboratory data.

All solvent extracts and digestates are collected for disposal following the thirty-day holding period and drummed according to their specific waste stream category. Chlorinated solvent extracts are drummed as chlorinated wastes (i.e., Methylene Chloride). Non-chlorinated solvent extracts are drummed as non-chlorinated wastes (i.e., acetone, hexane, methanol, and mixed solvents). Digestates are collected for disposal following the thirty-day holding period and drummed as corrosive liquid containing metals.

10.0 LABORATORY INSTRUMENTATION AND MEASUREMENT STANDARDS

Requirement: The laboratory has established procedures, which assure that instrumentation is performing to a pre-determined operational standard prior to the analysis of any samples. In general, these procedures follow the regulatory agency requirements established in promulgated methodology. The instrumentation selected to perform specified analysis are uniquely identified and capable of providing the method specified uncertainty of measurement needed. These procedures are documented and incorporated into the standard operating procedures for the method being executed.

10.1 ***Mass Tuning – Mass Spectrometers***. The mass spectrometer tune and sensitivity is monitored to assure that the instrument is assigning masses and mass abundances correctly and that the instrument has sufficient sensitivity to detect compounds at low concentrations. This is accomplished by analyzing a specific mass tuning compound at a fixed concentration. If the sensitivity is insufficient to detect the tuning compound, corrective action must be performed prior to the analysis of standards or samples. If the mass assignments or mass abundances do not meet criteria, corrective action must be performed prior to the analysis of standards or samples.

10.2 ***Wavelength Verification – Spectrophotometers***. Spectrophotometer detectors are checked on a regular schedule to verify proper response to the wavelength of light needed for the test in use. If the detector response does not meet specifications, corrective action (detector adjustment or replacement) is performed prior to the analysis of standards or samples.

10.3 ***Inter-element Interference Checks (Metals)***. Inductively Coupled Plasma Emission Spectrophotometers (ICP) are subject to a variety of spectral interferences, which can be minimized or eliminated by applying interfering element correction factors and background correction points. Interfering element correction factors are checked on a specified frequency through the analysis of check samples containing high levels of interfering elements. Analysis of single element interferant solutions is also conducted at a specified frequency.

If the check indicates that the method criteria have not been achieved for any element in the check standard, the analysis is halted and data from the affected samples are not reported. Sample analysis is resumed after corrective action has been performed and the correction factors have been re-calculated.

New interfering element correction factors are calculated and applied whenever the checks indicate that the correction factors are no longer meeting criteria. At a minimum, correction factors are replaced once a year.

Inductively Coupled Plasma – Mass Spectrometry (ICP-MS) also is subject to isobaric elemental and polyatomic ion interferences. These interferences are corrected through the use of calculations. The accuracy of corrections is dependent on the sample matrix and instrument conditions and is verified by quality control checks on individual runs.

10.4 ***Calibration and Calibration Verification***. Many tests require calibration using a series of reference standards to establish the concentration range for performing quantitative analysis. Instrument calibration is performed using standards that are traceable to national standards. Method specific procedures for calibration are followed prior to any sample analysis. In general, if a reference method does not specify the number of calibration standards, the minimum number is two (one of which is at the reporting limit or limit of quantitation).

Calibration is performed using a linear regression calculation or calibration factors calculated from the curve. The calibration must meet method specific criteria for linearity or precision. If the criteria are not achieved, corrective action (re-calibration or instrument maintenance) is performed. The instrument must be successfully calibrated before analysis of samples can be conducted.

Initial calibration for metals analysis performed using inductively coupled plasma (ICP) employs the use of a single standard and a calibration blank to establish linearity. Inductively Coupled Plasma – Mass Spectrometry (ICP-MS) can be calibrated using either a two point or a multi-point calibration, as long as all quality control criteria for the analysis can be achieved. The calibration blank contains all reagents that are placed into the calibration standard with the exception of the target elements. Valid calibration blanks must not contain any target elements.

Initial calibrations must be verified using a single concentration calibration standard from a second source (i.e. separate lot or different provider). The continuing validity of existing calibrations must be regularly verified using a single calibration standard. The response to the standard must meet pre-established criteria that indicate the initial calibration curve remains valid. If the criteria are not achieved corrective action (re-calibration) is performed before any additional samples may be analyzed.

If continuing calibration verification results are outside established criteria, data associated with the verification may be fully useable under the following conditions:

- When the acceptance criteria for the continuing calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported.

- When the acceptance criteria for the continuing calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level.

Calibration verification is also performed whenever it appears that the analytical system is out of calibration or no longer meets the calibration requirements. It is also performed when the time period between calibration verifications has expired.

Sample results are quantitated from the initial instrument calibration unless otherwise required by regulation, method, or program specific criteria.

10.5 ***Linear Range Verification and Calibration (ICP & ICP/MS Metals).*** Linear range verification is performed for all ICP and ICP/MS instrumentation. The regulatory program or analytical method specifies the verification frequency. A series of calibration standards are analyzed over a broad concentration range. The data from these analyses are used to determine the valid analytical range for the instrument. ICP instrument calibration is routinely performed using a single standard at a concentration within the linear range and a blank.

Some methods or analytical programs require a low concentration calibration check to verify that instrument sensitivity is sufficient to detect target elements at the reporting limit. The analytical method or regulatory program defines the criteria used to evaluate the low concentration calibration check. If the low calibration check fails criteria, corrective action is performed and verified through reanalysis of the low concentration calibration check before continuing with the field sample analysis. . ICP-MS instrument calibration is normally performed using multiple standards within the linear range and a blank, but may be done with a single standard at a concentration within the linear range and a blank.

10.6 ***Retention Time Development and Verification (GC).*** Chromatographic retention time windows are developed for all analysis performed using gas chromatographs with conventional detectors. An initial experimental study is performed, which establishes the width of the retention window for each compound. The retention time width of the window defines the time ranges for elution of specified target analytes on the primary and confirmation columns. Retention time windows are established upon initial calibration, applying the retention time range from the initial study to each target compound. Retention times are regularly confirmed through the analysis of an authentic standard during calibration verification. If the target analytes do not elute within the defined range during calibration verification, the instrument must be recalibrated and new windows defined. New studies are performed when major changes, such as column replacement are made to the chromatographic system.

10.7 ***Equipment List.*** See Appendix IV for a listing of all equipment used for measurement and/or calibration in laboratory processes.

11.0 INSTRUMENT MAINTENANCE

Requirement. Documented procedures have been established for conducting equipment maintenance. The procedure includes maintenance schedules if required or documentation of daily maintenance activities. All instrument maintenance activities are documented in instrument specific logbooks.

11.1 ***Routine, Daily Maintenance***. Routine, daily maintenance is required on an instrument specific basis and is performed each time the instrument is used. Daily maintenance includes activities to insure a continuation of good analytical performance. This may include performance checks that indicate if non-routine maintenance is needed. If performance checks indicate the need for higher level maintenance, the equipment is taken out of service until maintenance is performed. Analysis cannot be continued until all performance checks meet established criteria and a return to operational control has been demonstrated and documented. The individual assigned to the instrument is responsible for daily maintenance.

11.2 ***Non-routine Maintenance***. Non-routine maintenance is initiated for catastrophic occurrences such as instrument failure. The need for non-routine maintenance is indicated by failures in general operating systems that result in an inability to conduct required performance checks or calibration. Equipment in this category is taken out of service, tagged accordingly and repaired before attempting further analysis. Before initiating repairs, all safety procedures for safe handling of equipment during maintenance, such as lock-out/tag-out are followed. Analysis is not resumed until the instrument meets all operational performance check criteria, is capable of being calibrated and a return to operational control has been demonstrated and documented. Section supervisors are responsible for identifying non-routine maintenance episodes and initiating repair activities to bring the equipment on-line. This may include initiating telephone calls to maintenance contractors if necessary. They are responsible for documenting all details related to the occurrence and repair.

11.3 ***Scheduled Maintenance***. Modern laboratory instrumentation rarely requires regular preventative maintenance. If required, the equipment is placed on a schedule, which dictates when maintenance is needed. Examples include annual balance calibration by an independent provider or ICP preventative maintenance performed by the instrument manufacturer. Section supervisors are responsible for initiating scheduled maintenance on equipment in this category. Scheduled maintenance is documented using routine documentation practices.

11.4 ***Maintenance Documentation***. Routine and non-routine maintenance activities are documented in logbooks assigned to instruments and equipment used for analytical measurements. The logbooks contain preprinted forms, which specify the required maintenance activities. The analyst or supervisor performing or initiating the maintenance activity is required to check the activity upon its completion and initial the form. This includes documenting that the instrument has been returned to operational control following the completion of the activity. Non-routine maintenance (repairs, upgrades) is documented on the back page of the service log.

12.0 QUALITY CONTROL PARAMETERS, PROCEDURES, AND CORRECTIVE ACTION

Requirement: All procedures used for test methods incorporate quality control parameters to monitor elements that are critical to method performance. Each quality parameter includes acceptance criteria that have been established by regulatory agencies for the methods in use. Criteria may also be established through client dictates or through the accumulation and statistical evaluation of internal performance data. Data obtained for these parameters during routine analysis must be evaluated by the analyst, and compared to the method criteria in use. If the criteria are not achieved, the procedures must specify corrective action and conformation of control before proceeding with sample analysis. QC parameters, procedures, and corrective action must be documented within the standard operating procedures for each method. In the absence of client specific objectives the laboratory must define qualitative objectives for completeness and representativeness of data.

12.1 ***Procedure***. Bench analysts are responsible for methodological quality control and sample specific quality control. Each method specifies the control parameters to be employed for the method in use and the specific procedures for incorporating them into the analysis. These control parameters are analyzed and evaluated with every designated sample group (batch).

The data from each parameter provides the analyst with critical decision making information on method performance. The information is used to determine if corrective action is needed to bring the method or the analysis of a specific sample into compliance. These evaluations are conducted throughout the course of the analysis. Each control parameter is indicative of a critical control feature. Failure of a methodological control parameter is indicative of either instrument or batch failure. Failure of a sample control parameter is indicative of control difficulties with a specific sample or samples.

Sample Batch. All samples analyzed in the laboratory are assigned to a designated sample batch, which contains all required quality control samples and a defined maximum number of field samples that are prepared and/or analyzed over a defined time period. The maximum number of field samples in the batch is 20. Accutest has incorporated the NELAP batching policy as the sample-batching standard. This policy incorporates the requirement for blanks and spiked blanks as a time based function as defined by NELAP. Accordingly, the specified time period for a sample batch is 24 hours. Matrix spike/matrix spike duplicate, matrix spikes and duplicates are defined as sample frequency based functions and may be applied to several batches until the frequency requirement has been reached. A matrix spike/matrix spike duplicate, matrix spikes and/or duplicate is required every 20 samples.

Client criteria that defines a batch as a time based function which includes a matrix spike/matrix spike duplicates as a contractual specification will be honored. The typical batch contains a blank and a laboratory control sample (LCS or spiked blank). Batch documentation includes lot specifications for all reagents and standards used during preparation of the batch.

12.2 ***Methodological Control Parameters and Corrective Action***. Prior to the analysis of field samples the analyst must determine that the method is functioning properly. Specific control

parameters indicate whether critical processes meet specified requirements before continuing with the analysis. Method specific control parameters must meet criteria before sample analysis can be conducted. Each of these parameters is related to processes that are under the control of the laboratory and can be adjusted if out of control.

Method Blank. A method blank is analyzed during the analysis of any field sample. The method blank is defined as a sample. It contains the same standards (internal standards, surrogates, matrix modifiers, etc.) and reagents that are added to the field sample during analysis, with the exception of the sample itself. If the method blank contains target analytes(s) at concentrations that exceed method detection limit concentrations (organics) or reporting limit concentrations (inorganics), the source of contamination is investigated and eliminated before proceeding with sample analysis. Target analyte(s) in method blanks at concentrations no greater than one-half of the reporting limit concentrations (metals) may be requested on a client or project specific basis. Systematic contamination is documented for corrective action and resolved following the established corrective action procedures.

Laboratory Control Samples (LCS or Spiked Blanks). A laboratory control sample (spiked blank or commercially prepared performance evaluation sample) is analyzed along with field samples to demonstrate that method accuracy is within acceptable limits. These spike solutions may be from different sources than the sources of the solutions used for method calibration depending upon the method requirements. All target components are included in the spike mixture over a two year period. The performance limits are derived from published method specifications or from statistical data generated from the analysis of laboratory method performance samples. Spiked blanks are blank matrices (reagent water or clean sand) spiked with target parameters and analyzed using the same methods used for samples. Accuracy data is compared to laboratory derived limits to determine if the method is in control. Laboratory control samples (LCS) are commercially prepared spiked samples in an inert matrix. Performance criteria for recovery of spiked analytes are pre-established by the commercial entity preparing the sample. The sample is analyzed in the laboratory as an external reference.

Accuracy data is compared to the applicable performance limits. If the spike accuracy exceeds the performance limits, corrective action, as specified in the SOP for the method is performed and verified before continuing with a field sample analysis. In some cases, decisions are made to continue with sample analysis if performance limits are exceeded, provided the unacceptable result has no negative impact on the sample data.

Blanks and spikes are routinely evaluated before samples are analyzed. However, in situations where sample analysis is performed using an autosampler, they may be evaluated after sample analysis has occurred. If the blanks and spikes do not meet criteria, sample analysis is repeated.

Proficiency Testing. Proficiency test samples (PTs) are single or double blind spikes, introduced to the laboratory to assess method performance. PTs may be introduced as double blinds submitted by commercial clients, single or double blinds from regulatory agencies, or internal blinds submitted by the QA group.

A minimum of two single blind studies must be performed each year for every parameter in aqueous and solid matrices for each field of testing for which the laboratory maintains accreditation. Proficiency samples must be purchased as blinds from an A2LA accredited vendor. Data from these studies are provided to the laboratory by the vendor and reported to accrediting agencies. If unsatisfactory performance is noted, corrective action is performed to identify and eliminate any sources of error. A new single blind must be analyzed if required to demonstrate continuing proficiency.

PT samples performed for accrediting agencies or clients, which do not meet performance specifications, require a written summary that documents the corrective action investigation, findings, and corrective action implementation. A copy of this summary shall be submitted to the NELAC Primary Accrediting Authority, NJDEP Office of Quality Assurance for review.

Single or double blind proficiency test samples may be employed for self-evaluation purposes. Data from these analyses are compared to established performance limits. If the data does not meet performance specifications, the system is evaluated for sources of acute or systematic error. If required, corrective action is performed and verified before initiating or continuing sample analysis.

Trend Analysis for Control Parameters. The quality assurance staff is responsible for continuous analytical improvement through quality control data trend analysis. Accuracy data for spiked parameters in the spiked blank are statistically evaluated daily for trends indicative of systematic problems. Data from LCS parameters and surrogates are pooled on a method, matrix, and instrument basis. This data is evaluated by comparison to existing control and warning limits. Trend analysis is performed automatically as follows:

- Any point outside the control limit
- Any three consecutive points between the warning and control limits
- Any eight consecutive points on the same side of the mean.
- Any six consecutive points increasing or decreasing

The results of the trend analysis are transmitted as .PDF files for supervisory evaluation prior to sample analysis. Trends that indicate the potential loss of statistical control are further evaluated to determine the impact on data quality and to determine if corrective action is necessary. If corrective action is indicated, the supervisor informs the analysts of the corrective actions to be performed. Return to control is demonstrated before analysis resumes.

12.3 ***Sample Control Parameters and Corrective Action***. The analysis of samples can be initiated following a successful demonstration that the method is operating within established controls. Additional controls are incorporated into the analysis of each sample to determine if the method is functioning within established specifications for each individual sample. Sample QC data is evaluated and compared to established performance criteria. If the criteria are not achieved the method or the SOP specifies the corrective action required to continue sample analysis. In many cases, failure to meet QC criteria is a function of sample matrix and cannot be remedied. Each parameter is designed to provide quality feedback on a defined aspect of the sampling and analysis episode.

Duplicates. Duplicate sample analysis is used to measure analytical precision. This can also be equated to laboratory precision for homogenous samples. Precision criteria are method dependent. If precision criteria are not achieved, corrective action or additional action may be required. Recommended action must be completed before sample data can be reported.

Laboratory Spikes & Spiked Duplicates. Spikes and spiked duplicates are used to measure analytical precision and accuracy for the sample matrix selected. Precision and accuracy criteria are method dependent. If precision and accuracy criteria are not achieved, corrective action or additional action may be required. Recommended action must be completed before reporting sample data. All target components are included in the spike mixture over a two year period.

Serial Dilution (Metals). Serial dilutions of metals samples are analyzed to determine if analytical matrix effects may have impacted the reported data. If the value of the serially diluted samples does not agree with the undiluted value within a method-specified range, the sample matrix may be causing interferences, which may lead to either a high or low bias. If the serial dilution criterion is not achieved, it must be flagged to indicate possible bias from matrix effects.

Post Digestion Spikes. Digested samples are spiked and analyzed to determine if matrix interferences are biasing the results when the pre-digestion spike (matrix spike) recovery falls outside the control limits. It may also be used to determine potential interferences per client's specification. The sample is spiked at the concentration specified in the method SOP. No action is necessary if the post digestion spike is outside of the method criteria, unless a preparation problem is suspected with the spike, in which case the post digestion spike should be re-prepared and reanalyzed.

Surrogate Spikes (Organics). Surrogate spikes are organic compounds that are similar in behavior to the target analytes but unlikely to be found in nature. They are added to all quality control and field samples to measure method performance for each individual sample. Surrogate accuracy limits are derived from published method specifications or from the statistical evaluation of laboratory generated surrogate accuracy data. Accuracy data is compared to the applicable performance limits. If the surrogate accuracy exceeds performance limits, corrective action, as specified in the method or SOP is performed before sample data can be reported.

Internal Standards (Organic Methods). Internal standards are retention time and instrument response markers added to every sample to be used as references for quantitation. Their response is compared to reference standards and used to evaluate instrument sensitivity on a sample specific basis. Internal standard retention time is also compared to reference standards to assure that target analytes are capable of being located by their individual relative retention time.

If internal standard response criteria are not achieved, corrective action or additional action may be required. The recommended action must be completed before sample data can be reported.

If the internal standard retention time criteria are not achieved corrective action or additional action may be required. This may include re-calibration and re-analysis. Additional action must be completed before sample data is reported.

Internal Standards (ICP and ICP/MS Metals). Internal standards are used on ICP instruments to compensate for variations in response caused by differences in sample matrices. Multiple internal standards are used for each sample on ICP/MS instruments to compensate for variations in response caused by differences in sample matrices. This adjustment is performed automatically during sample analysis. The internal standard response of replicated sample analysis is monitored to detect potential analytical problems. If analytical problems are suspected, then the field samples may be reanalyzed or reanalyzed upon dilution to minimize the interferences. A different internal standard may be employed for quantitation in situations where the field sample contains the element typically used as the internal standard.

12.4 ***Laboratory Derived Quality Control Criteria.*** Control criteria for in-house methods and client specific modifications that exceed the scope of published methodology are defined and documented prior to the use of the method. The Quality Assurance Director is responsible for identifying additional control criteria needs. Control parameters and criteria, based on best technical judgment are established using input provided by the operations staff. These control parameters and criteria are documented and incorporated into the method.

The laboratory-derived criteria are evaluated for technical soundness on spiked samples prior to the use of the method on field samples. The technical evaluation is documented and archived by the Quality Assurance Staff.

When sufficient data from the laboratory developed control parameter is accumulated, the data is statistically processed and the experimentally derived control limits are incorporated into the method.

12.5 ***Bench Review & Corrective Action.*** The bench chemists are responsible for all QC parameters. Before proceeding with sample analysis, they are required to successfully meet all instrumental QC criteria. They have the authority to perform any necessary corrective action before proceeding with sample analysis. Their authority includes the responsibility for assuring that departures from documented policies and procedures do not occur.

The bench chemists are also responsible for all sample QC parameters. If the sample QC criteria are not achieved, they are authorized and required to perform the method specified corrective action before reporting sample data.

12.6 ***Data Qualifiers.*** An alpha character coding system is employed for defining use limitations for reported data. These limitations are applied to analytical data by the analyst to clarify the usefulness of the reported data for data user. Common data qualifiers and their definitions are as follows:

Organics.

J: Indicates an estimated value. Applied to calculated concentrations for tentatively identified compounds and qualitatively identified compounds whose concentration is below the reporting limit, but above the MDL.

N: Indicates qualitative evidence of a tentatively identified compound whose identification is based on a mass spectral library search and is applied to all TIC results.

C: Applied to pesticide data that has been qualitatively confirmed by GC/MS.

B: Used for analytes detected in the sample and its associated method blank.

E: Applied to compounds whose concentration exceeds the upper limit of the calibration range.

Metals and Inorganics.

B: Applied if the reported concentration value was less than the reporting limit but greater than the MDL.

U: Applied if the reading is less than the MDL (or IDL if IDL reporting is being used).

E: Estimated concentration caused by the presence of interferences, normally applied when the serial dilution is out.

N: Spike sample recovery not within control limits.

*: Duplicate or matrix spike duplicate analysis not within control limits.

12.7 ***QA Monitoring***. The QA staff conducts a spot review of completed data packages prior to client release for specified projects. This review includes an examination of QC data for compliance and trends indicative of systematic difficulties. If non-conformances are detected, the QA staff places an immediate stop on the release of the data and initiates corrective action to rectify the situation. The data package is released when the package becomes compliant with all quality requirements. If compliance is not possible, the data is qualified and an appropriate case narrative is generated for inclusion in the data package.

If the review reveals trends indicative of systematic problems, QA initiates an investigation to determine the cause. If process defects are detected, a corrective action is implemented and monitored for effectiveness.

Performance Limits. The Quality Assurance Director is responsible for compilation and maintenance of all precision and accuracy data used for performance limits. Quality control data for all test methods are accumulated and stored in the laboratory information management system (LIMS). Parameter specific QC data is extracted annually and statically processed to develop laboratory specific warning limits and control limits. The new limits are reviewed and approved by the supervisory staff prior to their use for data assessment. The new limits are used to evaluate QC data for compliance with method requirements for a period of one year. Laboratory generated limits appear on all data reports.

12.8 ***Data Package Review***. Accutest employs multiple levels of data review to assure that reported data has satisfied all quality control criteria and that client specifications and requirements have been met. Each production department has developed specific data review procedures, which must be completed before data is released to the client.

Analytical Review. The analyst conducts the primary review of all data. This review begins with a check of all instrument and method quality control and progresses through sample quality control, concluding with a check to assure that the client's requirements have been executed. Analyst checks focus on a review of qualitative determinations and checks of precision and accuracy data to verify that existing laboratory criteria have been achieved. Checks at this level may include comparisons with project specific criteria if applicable. The analyst has the authority and responsibility to perform corrective action for any out-of-control parameter or nonconformance at this stage of review.

Analysts who have met the qualification criteria for the method in use perform secondary, peer level data reviews. Analyst qualification requirements include a valid demonstration of capability and demonstrated understanding of the method SOP. Section supervisors may perform secondary review in-lieu of a peer review. Supervisors review 100% of the data produced by their department. It includes a check of all manual calculations; an accuracy check of manually transcribed data from bench sheets to the LIMS, a check of calibration and continuing calibration, all QC criteria and a comparison of the data package to client specified requirements. Also included are checks to assure the appropriate methodology was applied and that all anomalous information was properly flagged for communication in the case narrative. Supervisors have the authority to reject data and initiate re-analysis, corrective action, or reprocessing.

All laboratory data requiring manual entry into LIMS system is double-checked by the analysts performing initial data entry and the section supervisor. Verification of supervisory review is indicated on the raw data summary by the supervisor's initials and date.

Electronic data that is manually edited at the bench by the primary analyst is automatically flagged by the instrument data system indicating an override by the analyst. All manual overrides must be verified and approved by a supervisor who initials and dates all manual changes.

Hard copies of manually integrated chromatographic peaks are printed that clearly depict the manually drawn baseline. The hard copy is reviewed and approved by the section supervisor (initialed and dated) and included in the data package of all full tier reports or the archived batch records of commercial report packages.

Edits to electronic data that have already been committed to the LIMS database are controlled through the use of the Master Edit function in LIMS. Permission to access this program is limited to those approved by the upper levels of laboratory management and is controlled by the Information Technology staff. A GALP electronic audit record trail is maintained for all changes that are made and is automatically appended to the record.

The group manager performs a tertiary review on a spot check basis. This review includes an evaluation of QC data against acceptance criteria and a check of the data package contents to assure that all analytical requirements and specifications were executed.

Report Generation Review. The report generation group reviews all data and supporting information delivered by the laboratory for completeness and compliance with client specifications. Missing deliverables are identified and obtained from the laboratory. The group also reviews the completed package to verify that the delivered product complies with all client specifications. Non-analytical defects are corrected before the package is sent to the client.

Project Management/Quality Control Review. Spot-check data package reviews are performed by the project management staff. Project management reviews focus on project specifications. If the project manager identifies defects in the product prior to release, he initiates immediate corrective action to rectify the situation.

The QA staff performs a post-delivery check of completed data packages to verify completeness and compliance with established quality control procedures. Approximately 10% of Full-Deliverables data packages are reviewed. A formal checklist is used to assess data report completeness and accuracy. Detected deficiencies are documented on the checklist and corrective actions initiated as necessary. Data review checklists are electronic documents, which are archived in the QA Directory of the network server.

The QA review focuses on all elements of the deliverable including the client's specifications and requirements, analytical quality control, sample custody documentation and sample identification. QA reviews at this step in the production process are geared towards systematic process defects, which require procedural changes to effect a corrective action. However, if defects are identified that have an adverse affect on data, the client is immediately informed following standard notification procedures. QA data review is not used in lieu of a peer level review or a supervisory review.

Data Reporting. Analytical data is released to clients following a secondary review by the group supervisor. Data release at this stage of the process is limited to electronic information, which is released to clients through a secure, encrypted, password protected, Internet connection. Hard copy support data is compiled by the report generation group and assembled into the final report. The report is sent to the client following reviews by the report generation staff.

All data reports include specified information, which is required to identify the report and its contents. This information includes a title, name and address of the laboratory, a unique report number, total number of pages in the report, clients name and address, analytical method identification, arriving sample condition, sample and analysis dates, test results with units of measurement, authorized signature of data release, statement of applicability, report reproduction restrictions and NELAC requirements certification. Data reports for the Department of Defense ELAP also include the time of preparation and analysis.

12.9 ***Electronic Data Reduction.*** Raw data from sample analysis is entered into the laboratory information management system (LIMS) using automated processes or manual entry. Final data processing is performed by the LIMS using procedures developed by the Company.

All LIMS programs are tested and validated prior to use to assure that they consistently produce correct results. The Information Technology Staff performs software validation testing. The testing procedures are documented in an SOP. Software programs are not approved for use until they have demonstrated that they are capable of performing the required calculations.

12.10 ***Representativeness.*** Data representativeness is based on the premise that qualitative and quantitative information developed for field samples is characteristic of the sample that was collected by the client and analyzed in the laboratory. The laboratory objective for representativeness defines data as representative if the criteria for all quality parameters associated with the analysis of the sample are achieved.

12.11 ***Comparability.*** Analytical data is defined as comparable when data from a sample set analyzed by the laboratory is representatively equivalent to other sample sets analyzed separately regardless of the analytical logistics. The laboratory will achieve 100% comparability for all sample data which meets the criteria for the quality parameters associated with its analysis using the method requested by the client.

13.0 CORRECTIVE ACTION SYSTEM

Requirement. The laboratory employs polices and procedures for correcting defective processes, systematic errors, and quality defects enabling the staff to systematically improve product quality. The system includes procedures for communicating items requiring corrective action to responsible individuals, corrective action tracking procedures, corrective action documentation, monitoring of effectiveness, and reports to management. The system is fully documented in a standard operating procedure. Individual corrective actions and responses are documented in a dedicated database.

13.1 ***Procedure***. Corrective action is the step that follows the identification of a process defect. The type of defect determines the level of documentation, communication, and training necessary to prevent re-occurrence of the defect or non-conformance. The formal system is maintained by the quality assurance department. Operations management is responsible for working within the system to resolve identified deficiencies.

Routine Corrective Action. Routine corrective action is defined as the procedures used to return out of control analytical systems back to control. This level of corrective action applies to all analytical quality control parameters or analytical system specifications.

Bench analysts have full responsibility and authority for performing routine corrective action. The resolution of defects at this level does not require a procedural change or staff re-training. The analyst is free to continue work once corrective action is complete and the analytical system has been returned to control. Documentation of routine corrective actions is limited to logbook comments for the analysis being performed.

Process Changes. Corrective actions in this category require procedural modifications. They may be the result of systematic defects identified during audits, the investigation of client inquiries, failed proficiency tests, product defects identified during data review, or method updates. Resolution of defects of this magnitude requires formal identification of the defect, development and documentation of a corrective action plan, and staff training to communicate the procedural change.

Technical Corrective Action. Technical corrective action encompasses routine corrective action performed by bench analysts for out of control systems and corrective actions performed for data produced using out of control systems. Technical corrective action for routine situations is conducted using the procedures detailed above.

Non-routine corrective actions apply to situations where the bench analysts failed to perform routine corrective action before continuing analysis. Supervisors and Department Managers perform corrective action in these situations. Documentation of all non-routine corrective actions is performed using the corrective action system.

Sample re-analysis is conducted if sufficient sample and holding time remain to repeat the analysis using an in-control system. If insufficient sample or holding time remains, the data is processed and qualifiers applied that describe the out of control situation. The occurrence is

further documented in the case narrative and in the corrective action response. The corrective action must include provisions for retraining the analysts who failed to perform routine corrective action.

13.2 ***Documentation & Communication***. Routine corrective actions are documented as part of the analytical record. Notations are made in the comments section of the analytical chronicle or data sheet detailing the nonconformance and corrective action. Continuation of the analysis indicates that return to control was successful.

Corrective actions for process changes are documented, tracked and monitored for effectiveness. Supervisors or senior staff members may initiate corrective actions by generating a corrective action using the corrective action database application.

The corrective action database is an Access application. The initiator generates the corrective action investigation form, which is documented, tracked, distributed to responsible parties and archived through the application. The application assigns a tracking number, initiation data and due date to each action and copies the corrective action form to the database. E-mail message containing the form is automatically distributed to the responsible parties for resolution.

The responsible party identifies the root cause of the defect, initiates the immediate fix and develops and implements the procedural change. Existing documentation such as SOPs are edited to reflect the change. The affected staff is informed of the procedural change through a formal training session. The training is documented and copies are placed into individual training files. The corrective action form is completed by the responsible party and returned to the QA staff via e-mail using the database application.

Initial and completed corrective action forms are maintained in the corrective action database. This entire database is backed up and archived daily. The corrective action tracking form is maintained as an active report in the database.

Monitoring. The QA Staff monitors the implemented corrective action until it is evident that the action has been effective and the defect has been eliminated. The corrective action database is updated by QA to reflect closure of the corrective action. The QA staff assigns an error code to the corrective action for classification of the type of errors being committed. Additional monitoring of the corrective action is conducted during routine laboratory audits.

Additional monitoring of the corrective action is conducted by adding the corrective action to a verification list by the QA staff at closure. Verification is performed by the QA Staff to assure that the corrective action has remained in effect is scheduled for six (6) months from the initial closure date.

If QA determines that the corrective action response has not effectively remedied the deficiency, the process continues with a re-initiation of the corrective action. Corrective action continues until the defect is eliminated. If another procedural change is required, it is treated as a new corrective action, which is documented and monitored using established procedures.

Client Notification. Defective processes, systematic errors, and quality defects, detected during routine audits may have negative impacts on data quality. In some cases, data that has been released to clients may be affected. If defective data has been released for use, Accutest will notify the affected clients of the defect and provide specific details regarding the magnitude of the impact to their data.

14.0 PROCEDURES FOR EXECUTING CLIENT SPECIFICATIONS

Requirement. Systems have been established for evaluating and processing client specifications for routine and non-routine analytical services. The systems enable the client services staff to identify, evaluate, and document the requested specifications to determine if adequate resources are available to perform the analysis. The system includes procedures for communicating the specifications to the laboratory staff for execution and procedures for verifying the specifications have been executed.

14.1 ***Client Specific Requirements.*** The project manager is the primary contact for clients requesting laboratory services. Client specifications are communicated using several mechanisms. The primary sources of information are the client's quality assurance project plan (QAPjP) and the analytical services contract both of which detail the analytical, quality control and data reporting specifications for the project. In the absence of a QAPjP, projects specifications can also be communicated using contracts, letters of authorization, or letters of agreement, which may be limited to a brief discussion of the analytical requirements and the terms and conditions for the work. These documents may also include pricing information, liabilities and scope of work, in addition to the analytical requirements. QAPjPs include detailed analytical requirements and data quality objectives, which supersede those found in the referenced methods. This information is essential to successful project completion.

The client services staff provides additional assistance to clients who are unsure of the specifications they need to execute the sampling and analysis requirements of their project. They provide additional support to clients who require assistance in results interpretation as needed, provided they possess the expertise required to render an opinion.

The project manager is responsible for obtaining project documents, which specify the analytical requirements. Following project management review, copies are distributed to the QA Director and the appropriate departmental managers for review and comment. The original QAPjP is filed in a secure location.

14.2 ***Requirements for Non-Standard Analytical Specifications.*** Client requirements that specify departures from documented policies, procedures, or standard specifications must be submitted to Accutest in writing. These requirements are reviewed and approved by the technical staff before the project is accepted. Once accepted, the non-standard requirements become analytical specifications, which follow the routine procedure for communicating client specifications. Departures from documented policies, procedures, or standard specifications that do not follow this procedure are not permitted.

14.3 ***Evaluation of Resources.*** A resource evaluation is completed prior to accepting projects submitted by clients. The evaluation is initiated by the client services staff who prepares a brief synopsis that includes the logistical requirements of the project. Logistical specifications for new projects are summarized in writing for evaluation by the affected departments. The specifications are evaluated by the department manager from a scheduling and hardware resources perspective. The project is not accepted unless the department managers have the necessary resources to execute the project according to client specifications.

14.4 ***Documentation***. New projects are initiated using a project set up form, which is completed prior to the start of the project. This form details all of the information needed to correctly enter the specifications for each client sample into the laboratory information management system (LIMS). The form includes data reporting requirements, billing information, data turnaround times, QA level, state of origin, and comments for detailing project specific requirements. The project manager is responsible for obtaining this information from the client and completing the form prior to sample arrival and login.

Sample receipt triggers project creation and the login process. The information on the set-up form is entered into the LIMS immediately prior to logging in the first sample. The set up form may be accompanied by a quotation, which details the analytical product codes and sample matrices. These details are also entered into the LIMS during login.

Special information is distributed to the laboratory supervisors and login department in electronic or hardcopy format upon project setup. All, project specific information is retained by the project manager in a secure file. The project manager maintains a personal telephone log, which details conversations with the client regarding the project.

Department managers prepare summary sheets that detail client specific analytical requirements for each test. Bench analysts use these sheets to obtain information regarding client specific analytical requirements before analyzing samples. A program code is established for each client that links the client specifications to a client project. This code is attached to a project by the project manager at login and listed on the work list for each work group conducting analysis for clients with standing requirements.

14.5 ***Communication***. A pre-project meeting is held between client services and the operations managers to discuss the specifications described in the QAPjP, contract and/or related documents. Project logistics are discussed and finalized and procedures are developed to assure proper execution of the client's analytical specifications and requirements. Questions, raised in the review meeting, are discussed with the client for resolution. Exceptions to any requirements, if accepted by the client, are documented and incorporated into the QAPjP or project documentation records.

Non-standard specifications for individual clients are documented in the LIMS at the client account level or program level. Simple specifications are documented as comments for each project. Once entered into the LIMS, these specifications become memorialized for all projects related to the client account. Complex specifications are assigned program codes that link the specification to detailed analytical specifications.

Upon sample arrival, these specifications are accessed through a terminal or printed as a hard copy and stored in a binder for individuals who require access to the specification. Specifications that are not entered into the LIMS are prohibited unless documented in an interdepartmental memo, which clearly identifies the project, client and effective duration of the specification.

14.6 ***Operational Execution***. A work schedule is prepared for each analytical department on a daily basis. Analytical specifications or program codes from recently arrived samples have now been entered into the LIMS database. The database is sorted by analytical due date and holding time, into product specific groups. Samples are scheduled for analysis by due date and holding time. The completed schedule, which is now defined as a work list, is printed. The list contains the client requested product codes, program codes and specifications required for the selected sample(s). Special requirements are communicated to the analyst using the comments section or relayed through verbal instructions provided by the supervisor. The bench analyst assumes full responsibility for performing the analysis according to the specifications printed on the work sheet.

14.7 ***Verification***. Prior to the release of data to the client, laboratory section managers and the report generation staff review the report and compare the completed product to the client specifications documentation to assure that all requirements have been met. Project managers perform a spot check of projects with unique requirements to assure that the work was executed according to specifications.

15.0 CLIENT COMPLAINT RESOLUTION PROCEDURE

Requirement. The laboratory follows a formal system for managing and reconciling client complaints. The system includes procedures for documenting the complaint and communicating it to the appropriate department for resolution. The system also includes a quality assurance evaluation to determine if the complaint is related to systematic defects requiring corrective action and process changes.

15.1 ***Procedure***. Client complaints are communicated to client services representatives, quality assurance staff, or senior management staff for resolution. The individual receiving the complaint retains the responsibility for documentation and communicating the nature of the complaint to the responsible department(s) for resolution. The responsible party addresses the complaint. The resolution is communicated to quality assurance (QA) and the originator for communication to the client. QA reviews the complaint and resolution to determine if systematic defects exist. If systematic defects are present, QA initiates a corrective action for the responsible party who develops and implements a response that eliminates the defect. If systematic defects are not present and the resolution is satisfactory, the QA Staff will close the complaint/inquiry with a no further action is necessary tag.

15.2 ***Documentation***. Client's complaints are documented by the individual receiving the complaint using the Data Query and Corrective Action Inquiry Process. This process generates an E-Mail message that contains detailed information essential to the complaint resolution. A record of the telephone conversation is maintained by client services. The message is distributed to the QA staff and the party bearing responsibility for resolution by E-Mail. The complaint resolution is documented on the message by the responsible party and returned to the originator. A copy is sent to QA for review and database archiving.

15.3 ***Corrective Action***. Responses to data queries are required from the responsible party. At a minimum, the response addresses the query and provides an explanation to the complaint. Formal corrective action may focus on the single issue expressed in the complaint. Corrective action may include reprocessing of data, editing of the initial report, and re-issue to the client. If the QA review indicates a systematic error, process modification is required. The defective process at the root of the complaint is changed. SOPs are either created or modified to reflect the change. The party responsible for the process implements process changes.

15.4 ***QA Monitoring***. Process changes, implemented to resolve systematic defects, are monitored for effectiveness by QA. If monitoring indicates that the process change has not resolved the defect, QA works with the department management to develop and implement an effective process. If monitoring indicates that the defect has been resolved, monitoring is slowly discontinued and the corrective action is closed. Continued monitoring is incorporated as an element of the annual system audit.

16.0 CONTROL OF NONCONFORMING PRODUCT

Requirement: Policies and procedures have been developed and implemented that describe the procedures employed by the laboratory when any aspect of sample analysis or data reporting do not conform to established procedures or client specifications. These procedures include steps to ensure that process defects are corrected and affected work is evaluated to assess its impact to the client.

Procedure. Nonconforming product is identified through routine internal review and audit practices or through client inquiry. The individuals who identify the nonconformance or receiving a nonconformance inquiry immediately inform the Laboratory Director and the Quality Assurance Director. The Laboratory Director initiates an evaluation of the nonconformance through the Quality Assurance Department and takes full responsibility for managing the process and identifying the course of action to take, initiating corrective action and mitigating the impact of the nonconformance to the client.

16.1 ***Corrective Action.*** The outcome of the evaluation dictates the course of action. This includes client notification when the quality of data reported has been impacted and may also include corrective action if applicable. Immediate corrective action is performed using the procedures specified in Accutest SOP EQA011. However, additional action may be required including cessation of analysis and withholding and or recalling data reports. If the evaluation indicates that nonconforming data may have been issued to clients, the client is immediately notified and data may be recalled following the procedures specified in SOP EQA011. If work has been stopped because of a nonconformance, the Laboratory Director is the only individual authorized to direct a resumption of analysis.

Nonconformances caused by systematic process defects require retraining of the personnel involved as an element of the corrective action solution.

17.0 CONFIDENTIALITY PROTECTION PROCEDURES

Requirements: Policies and procedures have been developed to protect client data from release to unauthorized parties or accidental release of database information through accidental electronic transmission or illegal intrusion. These policies have been communicated to clients and staff. Electronic systems are regularly evaluated for effectiveness.

17.1 ***Client Anonymity***. Information related to the Company's clients is granted to employees on a "need to know" basis. An individual's position within the organization defines his "need to know". Individuals with "need to know" status are given password access to systems that contain client identity information and access to documents and document storage areas containing client reports and information. Access to client information by individuals outside of the Company is limited to the client and individuals authorized by the client.

Individuals outside of the Company may obtain client information through subpoena issued by a court of valid jurisdiction. Clients are informed when subpoenas are received ordering the release of their information.

Client information may be released directly to regulatory agencies without receiving client authorization under specified circumstances. These circumstances require that the regulatory agency have statutory authority under the regulations for laboratory certification and that Accutest's operations fall under the purview of the regulation. In these situations, Accutest will inform the client of the regulatory agencies request for information pertaining to his data and proceed with the delivery of the information to the regulatory agency.

17.2 ***Documents***. Access to client documents is restricted to employees in need to know positions. Copies of all client reports are stored in secure electronic archives with restricted access. Reports and report copies are distributed to individuals who have been authorized by the client to receive them. Data reports or data are not released to third parties without verbally expressed or written permission from the client.

17.3 ***Electronic Data***.

Database Intrusion. Direct database entry is authorized for employees of Accutest only on a need to know basis. Entry to the database is restricted through a user specific multiple password entry system. Direct access to the database outside of the facility is possible through a dial-up connection. A unique password is required for access to the local area network. A second unique password is required to gain access to the database. The staff receives read or write level authorization on a hierarchical privilege basis.

Internet Access. Access to client information is through an HTTP Web application only. It does not contain a mechanism that allows direct access to the database. Clients can gain access to their data only using a series of Accutest assigned client and user specific passwords. The viewable data, which is encrypted during transmission, consists of an extraction of database information only.

Client Accessibility. Accessibility to client data delivered via electronic means follows strict protocols to insure confidentiality. Clients accessing electronic data are assigned a company account. The account profile, which is established by the MIS staff, grants explicit access to specific information pertaining to the client's project activity. Passwords are assigned on an individual basis within a client account. These accounts can be activated or deactivated by the MIS staff only.

17.4 ***Information Requests***. Client specific data or information is not released to third parties without verbally expressed or written permission from the client. Written permission is required from third parties, who contact the Company directly for the release of information. Verbal requests will be honored only if they are received directly from the client. These requests must be documented in a record of communication maintained by the authorized recipient.

17.5 ***Transfer of Records***. Archived data, which has previously been reported and transmitted to clients, is the exclusive property of Accutest Laboratories. In the event of a cessation of business activities due to business failure or sale, The Company's legal staff will be directed to arrange for the final disposition of archived data.

The final disposition of archived data will be accomplished using the approach detailed in the following sequence:

1. All data will be transferred to the new owners for the duration of the required archive period as a condition of sale.

2. If the new owners will not accept the data or the business has failed, letters will be sent to clients listed on the most recent active account roster offering them the option to obtain specific reports (identified by Accutest Job Number) at their own expense.

3. A letter will be sent to the NELAC accrediting authority with organizational jurisdiction over the company offering them the option to obtain all unclaimed reports at their own expense.

4. All remaining archived data will be recycled using the most expedient means possible.

18.0 QUALITY AUDITS AND SYSTEM REVIEWS

Requirement: The quality assurance group conducts regularly scheduled audits of the laboratory to assess compliance with quality system requirements, technical requirements of applied methodology, and adherence to documentation procedures. The information gathered during these audits is used to provide feedback to senior management and perform corrective action where needed for quality improvement purposes.

18.1 ***Quality System Reviews***. Quality system reviews are performed annually by the Quality Assurance Director for the Company President. In this review, the laboratory is evaluated for compliance with the laboratory Quality Systems Manual (QSM) and the quality system standards of the National Environmental Laboratory Accreditation Conference. Findings, which indicate non-compliance or deviation from the QSM, are flagged for corrective action. Corrective actions require either a return to compliance or a plan change to reflect an improved quality process. The Quality Assurance Director is responsible for making and documenting changes to the QSM. These changes are reviewed by the Company President and The Laboratory Director prior to the approval of the revised system.

18.2 ***Quality System Audits.*** Quality system audits are conducted to evaluate the effectiveness and laboratory compliance with individual quality system elements. These audits are conducted on an established schedule. Audit findings are documented and communicated to the management staff and entered into the corrective action system for resolution. If necessary, retraining is conducted to assure complete understanding of the system requirements.

18.3 ***Test Method Assessments.*** Test Method Assessments are performed throughout the year following an established schedule. Selected analytical procedures are evaluated for compliance with standard operating procedures (SOPs) and method requirements. If non-conformances exist, the published method serves as the standard for compliance. SOPs are edited for compliance if the document does not reflect method requirements. Analysts are trained to the new requirements and the process is monitored by quality assurance. Analysts are retrained in method procedures if an evaluation of bench practices indicates non-compliance with SOP requirements.

18.4 ***Documentation Audits***. Documentation audits are conducted monthly. This audit includes a check of measurement processes that require manual documentation. It also includes checks of data archiving systems and a search to find and remove any inactive versions of SOPs that may still be present in the laboratory and being accessed by the analysts. Non-conformances are corrected on the spot. Procedural modifications are implemented if the evaluation indicates a systematic defect.

18.5 ***Corrective Action Monitoring***. Defects or non-conformances that are identified during client or internal audits are documented in the corrective action systems and corrected through process modifications and/or retraining. Once a corrective action has been designed and implemented, it is monitored for compliance on a regular basis by the QA staff. Spot

corrections are performed if the staff is not following the new procedure. Monitoring of the corrective action continues until satisfactory implementation has been verified.

18.6 ***Preventive Action.*** Laboratory systems or processes, which may be faulty and pose the potential for nonconformances, errors, confusing reports or difficulties establishing traceability may be identified during internal audits. These items are highlighted for systematic change using the corrective action system and managed to resolution using the procedures for corrective action identified in EQA011.

18.7 ***Client Notification.*** Defective processes, systematic errors, and quality defects, detected during routine audits may have negative impacts on data quality. In some cases, data that has been released to clients may be affected. If defective data has been released for use, Accutest will immediately notify the affected clients of the defect and provide specific details regarding the magnitude of the impact to their data.

18.8 ***Management Reports.*** Formal reports of all audit and proficiency testing activity are prepared for the management staff and presented as they occur. Additional reports may be presented orally at regularly scheduled staff meetings

Management reports may also address the following topics:

- Status and results of internal and external audits,
- Status and results of internal and external proficiency testing,
- Identification of quality control problems in the laboratory,
- Discussion of corrective action program issues,
- Status of external certifications and approvals,
- Status of staff training and qualifications,
- Discussion of new quality system initiatives.
- Recommendations for further action on listed items are included in the report.

19.0 HEALTH AND SAFETY

Requirement. The company operates a formal health and safety program that complies with the requirements of the Occupational Health and Safety Administration. The program consists of key policies and practices that are essential to safe laboratory operation. All employees are required to receive training on the program elements. Job specific training is conducted to assure safe practices for specific tasks. All employees are required to participate in the program, receive initial and annual training, and comply with the program requirements. All plan and program requirements are detailed in the Health and Safety Program Manual.

19.1 **Policy.** Accutest Laboratories will provide a safe and healthy working environment for its employees and clients while protecting the public and preserving the Company's assets and property. The company will comply with all applicable government regulations pertaining to safety and health in the laboratory and the workplace.

The objective of the Accutest Health and Safety Program is to promote safe work practices that minimize the occurrence of injuries and illness to the staff through proper health and safety training, correct laboratory technique application and the use of engineering controls.

19.2 **Responsibilities.** The Health and Safety Program assists managers, supervisors and non-supervisory employees in control of hazards and risks to minimize the potential for employee and client injuries, damage to client's property and damage or destruction to Accutest's facility.

The Health, Safety and Facilities Manager is responsible for implementing the Program's elements and updating its contents as necessary. He also conducts periodic audits to monitor compliance and assess the program's effectiveness. The Health, Safety and Facilities Manager is also responsible for creating and administering safety training for all new and existing employees.

The employee is responsible for following all safety rules established for their protection, the protection of others and the proper use of protective devices provided by the Company. The employee is also expected to comply with the requirements of the program at all times. Department Managers and Supervisors are responsible for ensuring the requirements of the Safety Program are practiced daily. The Company President retains the ultimate responsibility for the program design and implementation.

19.3 **Program Elements.** The Accutest Health and Safety Program consists of key program elements that compliment the company's health and safety objective. These elements form the essence of the health and safety policy and assure that the objectives of the program are achieved.

Safety Education and Training and Communication. Training is conducted to increase the staff's awareness of laboratory hazards and their knowledge of the safety practices and procedures required to protect them from those hazards. It is also used to communicate general safety procedures required for safe operation in a chemical laboratory.

Initial health and safety training for new employees is conducted during orientation. The training focuses on the Accutest Safety and Health Program and includes specific training for the hazards that may be associated with the employees duties. Training is also conducted for all program elements focusing on general, acceptable, laboratory safety procedures. Targeted training is conducted to address hazards or safety procedures that are specific to individual employee's work assignments. All training activities are documented and archived in individual training folders, A health and safety training inventory is maintained in the training database.

Safety Committee. The safety committee provides the employee with an opportunity to express their views and concerns on safety issues in a forum where those concerns will be addressed. This committee meets monthly to assure that the interests of the company and the well being of the employee are protected. They also serve as a catalyst for elevating the level of safety awareness among their peers.

Hazard Identification and Communication. The hazard communication program enables employees to readily identify laboratory hazards and the procedures to protect themselves from those hazards. This program complies with OSHA's Hazard Communication Standard, Title 29 Code of Federal Regulations 1910.1200 that requires the company to adopt and adhere to the following key elements:

- Material Safety Data Sheets (MSDS) must be available to any employee wishing to view them,
- The Company must maintain a Hazardous Chemicals Inventory (by location), which is updated on an annual basis,
- Containers are properly labeled,
- All employees must be provided with annual Hazard Communication and Right to Know training,

The hazard communication program also complies with the requirements of the New Jersey Worker and Community Right to Know Law, NJAC 8:95.

Identification of Workplace Hazards. The workplace hazard identification procedures have been designed to assure that hazards that have the potential to cause personnel injury or destruction of property are identified, managed and/or systematically eliminated from the operation. This system eliminates hazards, limits the potential for injury and increases the overall safety of the work environment.

Employee Exposure Assessment. Employee exposure assessment is performed to identify and evaluate potential exposure hazards associated with the employees work station. The exposure assessment data is used to determine if changes or modifications to the work station are needed to limit exposure to laboratory conditions that could negatively affect an employee's existing medical conditions.

Bloodborne Pathogens. Accutest has implemented the OSHA Bloodborne Pathogen Standard, 29CFR1910.1030 to reduce occupational exposure to Hepatitis B Virus (HBV), Human Immunodeficiency Virus (HIV) and other bloodborne pathogens that employees may encounter in their workplace.

Respiratory Protection Plan. The respiratory protection plan assures that Accutest employees are protected from exposure to respiratory hazards. This program is used in situations where engineering controls and/or safe work practices do not completely control the identified hazards. In these situations, respirators and other protective equipment are used. Supplemental respiratory protection procedures are applied to specified maintenance personnel, employees who handle hazardous wastes in the hazardous waste storage area, and any employee that voluntarily elects to wear a respirator.

Chemical Hygiene Plan. The Chemical Hygiene Plan complies with the requirements of the Occupational Safety and Health Administration's Occupational Exposure to Hazardous Chemicals in the Laboratory Standard, 29 CFR 1910.1450. This plan establishes procedures, identifies safety equipment, personal protective equipment, and work practices that protect employees from the potential health hazards presented by hazardous chemicals in the laboratory if properly used and/or applied.

Chemical Spill Response Plan. The chemical spill response plan has been designed to minimize the risks from a chemical spill or accidental chemical release in the laboratory. Risk minimization is accomplished through a planned response that follows a defined procedure. The staff has been trained to execute spill response procedures according to the specifications of the plan, which identifies the appropriate action to be taken based on the size of the spill.

Emergency Action & Evacuation Plan. The Emergency Action and Evacuation Plan details the procedures used to protect and safeguard Accutest's employees and property during emergencies. Emergencies are defined as fires or explosions, gas leaks, building collapse, hazardous material spills, emergencies that immediately threaten life and health, bomb threats and natural disasters such as floods, hurricanes or tornadoes, terrorism or terrorist actions. The plan identifies and assigns responsibility for executing specific roles in situations requiring emergency action. It also describes the building security actions coinciding with the "Alert Condition", designated by the Department of Homeland Security.

Lockout/Tagout Plan. Lockout/tagout procedures have been established to assure that laboratory employees and outside contractors take steps to render equipment inoperable and/or safe before conducting maintenance activities. The plan details the procedures for conducting maintenance on equipment that has the potential to unexpectedly energize, start up, or release energy or can be operated unexpectedly or accidentally resulting in serious injury to employees. The plan ensures that employees performing maintenance render the equipment safe through lock out or tag out procedures.

Personal Protection Policy. Policies have been implemented which detail the personal protection requirements for employees. The policy includes specifications regarding engineering controls, personal protective equipment (PPE), hazardous waste, chemical exposures, working

with chemicals and safe work practices. Safety requirements specific to processes or equipment are reviewed with the department supervisor or the Health and Safety Manager before beginning operations.

Visitor and Contractor Safety Program. A safety brochure is given to all visitors and contractors who visit or conduct business at the facility. The brochure is designed to inform anyone who is not an employee of Accutest Laboratories of the laboratories safety procedures. The brochure directs them to follow all safety programs and plans while on Accutest property. This program also outlines procedures for visitors and contractors in the event of an emergency. Visitors are required to acknowledge receipt and understanding of the Accutest policy annually.

Appendix I

Glossary of Terms

GLOSSARY OF TERMS

Acceptance Criteria: specified limits placed on characteristics of an item, process, or service defined in requirement documents.

Accuracy: the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.

Analyst: the designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

Audit: a systematic evaluation to determine the conformance to quantitative *and qualitative* specifications of some operational function or activity.

Batch: environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to 20 environmental samples of the same NELAC-defined matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group.

Blank: a sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results.

Blind Sample: a sub-sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process.

Calibration: to determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter, instrument, or other device. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements.

Calibration Curve: the graphical relationship between the known values, such as concentrations of a series of calibration standards and their instrument response.

Calibration Method: a defined technical procedure for performing a calibration.

Calibration Range: the range of concentrations between the lowest and highest calibration standards of a multi-level calibration curve. For metals analysis with a singe-point calibration, the low-level calibration check standard and the high standard establish the linear calibration range, which lies within the linear dynamic range.

Calibration Standard: a substance or reference material used to calibrate an instrument.

Certified Reference Material (CRM): a reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation, which is issued by a certifying body.

Chain of Custody: an unbroken trail of accountability that ensures the physical security of samples and includes the signatures of all who handle the samples.

Confirmation: verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to second column confirmation, alternate wavelength, derivatization, mass spectral, interpretation, alternative detectors or, additional cleanup procedures.

Continuing Calibration Verification: the verification of the initial calibration that is required during the course of analysis at periodic intervals. Continuing calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models.

Corrective Action: the action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence.

Data Reduction: the process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form.

Demonstration of Capability: a procedure to establish the ability of the analyst to generate acceptable accuracy.

Document Control: the act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed.

Duplicate Analyses: the analyses or measurements of the variable of interest performed identically on two sub-samples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory.

Field of Testing: NELAC's approach to accrediting laboratories by program, method and analyte. Laboratories requesting accreditation for a program-method-analyte combination or for an up-dated/improved method are required submit to only that portion of the accreditation process not previously addressed (see NELAC, section 1.9ff).

Laboratory Control Sample (such as laboratory fortified blank, spiked blank, or QC check sample): a sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes from a source independent of the calibration standards or a material containing known and

verified amounts of analytes. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

Limit of Detection (LOD): an estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte- and matrix-specific. DoD clarification is the smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate (Type II error) is 1%.

Limit of Quantitation (LOQ): the minimum levels, concentrations, or quantities of a target analyte that can be reported with a specified degree of confidence. DoD clarification is the lowest concentration that produces a quantitative result within specified limits of precision and bias. The LOQ shall be at or above the concentration of the lowest initial calibration standard.

Matrix: the component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

Aqueous: any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.

Drinking Water: any aqueous sample that has been designated a potable or potential potable water source. Saline/Estuarine: any aqueous sample from an ocean or estuary, or other salt-water source such as the Great Salt Lake. Non-aqueous Liquid: any organic liquid with <15% settleable solids.

Solids: includes soils, sediments, sludges and other matrices with >15% settlable solids.

Chemical Waste: a product or by-product of an industrial process that results in a matrix not previously defined.

Air: whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbent tube, impinger solution, filter, or other device.

Biota: animal or plant tissue, consisting of entire organisms, homogenates, and/or organ or structure specific subsamples.

Matrix Spike (spiked sample or fortified sample): a sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix Spike Duplicate (spiked sample or fortified sample duplicate): a second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.

Method Blank: a sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest, which is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.

Method Detection Limit: the minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

National Environmental Laboratory Accreditation Program (NELAP): the overall National Environmental Laboratory Accreditation Program.

NELAC Standards: the plan of procedures for consistently evaluating and documenting the ability of laboratories performing environmental measurements to meet nationally defined standards established by the National Environmental Laboratory Accreditation Conference.

Performance Audit: the routine comparison of independently obtained *qualitative and quantitative* measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory.

Precision: the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms.

Preservation: refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample.

Proficiency Testing: a means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source.

Proficiency Test Sample (PT): a sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria.

Quality Assurance: an integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.

Quality Control: the overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users.

Quality Manual: a document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.

Quality System: a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC.

Reporting Limits: the maximum or minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be quantified with the confidence level required by the data user.

Reagent Blank (method reagent blank or method blank): a sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps.

Reference Material: a material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

Reference Method: a method of known and documented accuracy and precision issued by an organization recognized as competent to do so.

Reference Standard: a standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived.

Replicate Analyses: the measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval.

Sample Duplicate: two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method including sampling and analysis.

Spike: a known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

Standard: the document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of NELAC and meets the approval requirements of NELAC procedures and policies.

Traceability: the property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons.

Validation: the process of substantiating specified performance criteria.

Work Cell: A defined group of analysts that together perform the method analysis. Members of the group and their specific functions within the work cell must be fully documented. A "work cell" is considered to be all those individuals who see a sample through the complete process of preparation, extraction, or

analysis. The entire process is completed by a group of capable individuals; each member of the work cell demonstrates capability for each individual step in the method sequence.

Appendix II

Standard Operating Procedures Directory

Accutest Laboratories
Standard Operating Procedures

Section	Standard Operating Procedure Title	Number
Air Toxics	Air Analysis by TO-15	EAT001
Air Toxics	Summa Canister Cleaning and Certification	EAT002
Air Toxics	Air Analysis of Tedlar Bag/Summa Canister by TO-3	EAT003
Air Toxics	Laboratory Analysis of Dissolved Gases in Aqueous Samples	EAT004
Air Toxics	Air Analysis by NJDEP – SRWM Low Level USEPA TO-15	EAT005
Air Toxics	Calibration of Flow Controllers	EAT006
Air Toxics	Air Analysis by TO-15 for Minnesota Department of Health	ETA007
General Chem	Percent Solids - EPA 160.3, ASTM D4643-00	EGN007
General Chem	Anionic Surfactants As MBAS	EGN008
General Chem	Nonionic Surfactants as CTAS	EGN009
General Chem	Total Solids, 160.3	EGN010
General Chem	Composite Sample	EGN015
General Chem	Total Dissolved Solids (Total Filterable Residue)	EGN020
General Chem	Settlable Solids, 160.5	EGN021
General Chem	Nitrate/Nitrite & Nitrate Only By Cad. Red. Analysis	EGN026
General Chem	Total Volatile Solids, 160.4	EGN030
General Chem	Chlorine, Total Residual And Free	EGN033
General Chem	Total Alkalinity, 310.1	EGN037
General Chem	Acidity (pH 8.2)	EGN044
General Chem	Bicarbonate, Carbonate, Free Carbon Dioxide	EGN045
General Chem	Petroleum Hydrocarbons By IR	EGN062
General Chem	Viscosity	EGN067
General Chem	Total Suspended Solids (Non-Filterable Residue)	EGN087
General Chem	Chemical Oxygen Dem: Hach 8000, Aqueous Samples - Soil Modified	EGN099
General Chem	Hardness As Caco3 By Titration	EGN101
General Chem	Orthophosphate	EGN102
General Chem	Nitrogen, Nitrite -Total-Waters/Soluble-Soils	EGN103
General Chem	Turbidity, 180.1	EGN116
General Chem	Sulfide	EGN118
General Chem	Sulfite.	EGN119
General Chem	Apparent Color By Visual Comparison Method	EGN120
General Chem	Specific Conductance At 25.0 C	EGN124
General Chem	Chloride	EGN131
General Chem	Turbidity for Metals Drinking Waters	EGN132
General Chem	Odor & Odor at Elevated Temp.(Threshold Odor Test)	EGN133
General Chem	Biological Oxygen Demand (5 Day BOD)	EGN134
General Chem	Winkler Titration For DO Standardization	EGN135
General Chem	Dissolved Oxygen	EGN136
General Chem	Reactive Sulfide And Reactive Cyanide	EGN137
General Chem	Ignitability	EGN140
General Chem	TCLP - Semivolatiles/Metals Extraction	EGN141
General Chem	TCLP- Volatiles Extraction	EGN142
General Chem	Paint Filter Test	EGN143
General Chem	Cyanides Amenable To Chlorination Preparation	EGN144

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Section	Standard Operating Procedure Title	Number
General Chem	Temperature	EGN146
General Chem	Iodine, Colorimetric Analysis	EGN148
General Chem	pH by Electrode – Water	EGN151
General Chem	Salinity - SM182520B	EGN158
General Chem	pH & Corrosivity for Soils/ Solid Wastes SW486 9045	EGN200
General Chem	BTU (Gross Calorific Value)	EGN202
General Chem	Percent Sulfur	EGN203
General Chem	Bulk Density (Dry Basis)	EGN204
General Chem	Percent Ash (Dry Basis)	EGN205
General Chem	Total Organic Content	EGN206
General Chem	Cyanide (Lachat Autoanalyzer)	EGN207
General Chem	Total Chlorine ASTM D808-91	EGN208
General Chem	Total Organic Chlorine ASTM D808-91	EGN209
General Chem	Total Kjeldahl Nitrogen (Lachat Autoanalyzer)	EGN210
General Chem	Specific Gravity	EGN211
General Chem	Hexavalent Chromium (Soils)	EGN214
General Chem	Ammonia (Lachat Autoanalyzer)	EGN216
General Chem	Phenols (Lachat Autoanalyzer)	EGN217
General Chem	Total Organic Halides	EGN218
General Chem	Total Organic Halides, Solid And Oil Matrices	EGN219
General Chem	Pour Point	EGN221
General Chem	Base Sediment In Petroleum Samples	EGN222
General Chem	Water Content In Petroleum Samples	EGN223
General Chem	Organic Matter (Loss on Ignition)	EGN227
General Chem	Sulfide Analysis For Reactive Sulfides	EGN228
General Chem	Hexavalent Chromium In Waters by EPA 7196a Mod.	EGN230
General Chem	Hexavalent Chromium In Waters by SM18 4500 CR D	EGN231
General Chem	Total Petroleum Hydrocarbons by IR With ASE Extract.	EGN232
General Chem	Total Organic Carbon In Soil Samples	EGN233
General Chem	Total Organic Carbon In Aqueous Samples	EGN234
General Chem	pH and Corrosivity for Aqueous and Multiphasic Wastes	EGN238
General Chem	Synthetic Precipitation Leaching Procedure for Non-Volatile Anal.	EGN239
General Chem	Synthetic Precipitation Leaching Procedure for Volatile Analytes	EGN240
General Chem	Cation Exchange Capacity Of Soils (Sodium Acetate)	EGN242
General Chem	Ferrous Iron	EGN243
General Chem	Freon-113 Recycling Procedure	EGN246
General Chem	Specific Gravity (For Sludges And Solids)	EGN247
General Chem	N-Hexane Extract. Mat. & Silica Gel Treatment by Gravimetric Anal.	EGN249
General Chem	Oil & Grease – Gravimetric Anal. (So & Sl) – Hexane Extraction	EGN250
General Chem	Determination of Inorganic Anions By Ion Chromatography	EGN251
General Chem	Neutral Leaching of Solid Waste Sam. Using Shake Extraction	EGN252
General Chem	Oxidation-Reduction Potential	EGN253
General Chem	Titrametric Method For Free Carbon Dioxide	EGN255
General Chem	Total Phosphorous EPA 365.3	EGN256
General Chem	Dissolved Silica	EGN257
General Chem	Grain Size and Sieve Testing	EGN258

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Standard Operating Procedures

Section	Standard Operating Procedure Title	Number
General Chem	Hardness By Calculation	EGN259
General Chem	Spectrophotometer Calibration Check	EGN260
General Chem	Massachussetts Sieve Test	EGN262
General Chem	Volatile Suspended Solids	EGN264
General Chem	Unburned Combustibles (Volatile Solids)	EGN266
General Chem	Particulate Matter	EGN267
General Chem	Elutriate Preparation	EGN268
General Chem	Phosphorus, Hydrolyzable	EGN271
General Chem	Perchlorate by Ion Chromatography in Groundwater and Soil	EGN272
General Chem	Percent Lipids by Gravimetric Analysis	EGN273
General Chem	Cyanide Distillation/Aqueous Samples/Micro Method	EGN275
General Chem	Cyanide Distillation/Soil Samples/Micro Method	EGN276
General Chem	Calibration of General Chemistry Distillation Tubes	EGN277
General Chem	Phenols Distillation, Water Samples	EGN279
General Chem	Phenols Micro Distillation, Soil Samples	EGN280
General Chem	Inorganic Anions Determination by ion chromatography using IC 2000	EGN281
General Chem	Leaching of Solid Waste Samples using China Leaching Procedure	EGN283
General Chem	Ammonia Distillation, Water & Solid samples	EGN284
General Chem	Weak Acid Dissociable Cyanide / Micro-Distillation Method	EGN286
General Chem	Ferrous Iron for Hexavalent Chromium Sample Characterization	EGN288
General Chem	Calibration of Coliform Collection Bottles	EGN287
General Chem	Inorganic Carbon by Calculation	EGN289
General Chem	Procedure for Homogenization of Biota Samples	EGN290
General Chem	Hexavalent Chromium in Water by Ion Chromatography	EGN291
General Chem	Hexavalent Chromium in Soils by Ion Chromatography	EGN292
General Chem	Procedure for Wand Mixer Homogenization of Soil Samples	EGN293
General Chem	Hydrogen Sulfide	EGN294
General Chem	TCLPME-Multiple Extractions Procedure	EGN295
General Chem	Modified Elutriate Preparation	EGN296
General Chem	Procedure for Particle Size Reduction (Crushing) of Solid Matrices	EGN297
General Chem	Acid Volatile Sulfides	EGN298
General Chem	Pore Water Extraction from Soils for NVOC and Metals Analysis	EGN299
General Chem	Iodide, Colorimetric Analysis	EGN300
General Chem	Percent Solids and Moisture in Soil/Solid Matrices	EGN301
General Chem	Un-Ionized Ammonia	ENG302
General Chem	Density, ASTM Definition	EGN303
General Chem	HEM by Gravimetric Analysis Using Solid Phase Extraction	EGN304
General Chem	Hexavalent Chromium on Wipe Samples	EGN305
Facilities Maint.	Facilities Maintenance	EFM001
Field Operations	Aqueous Grab Sampling Procedures	EFP001
Field Operations	Use of Automatic Wastewater Sampler	EFP002
Field Operations	Free and Total residual Chlorine	EFP003
Field Operations	Decontamination of Sampling Equipment	EFP004
Field Operations	Dissolved Oxygen	EFP005

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Section	Standard Operating Procedure Title	Number
Field Operations	Dissolved Oxygen by Winkler Titration	EFP006
Field Operations	Metal Sample Field Filtering Procedure	EFP008
Field Operations	Sampling Procedure for Monitoring Wells	EFP013
Field Operations	Subsurface Soil Sampling Procedure	EFP016
Field Operations	Surface Soil Sampling Procedure	EFP017
Field Operations	Residential Potable Well Sampling Procedure	EFP018
Field Operations	Potable Water Line Sampling Procedure	EFP019
Field Operations	Sampling for NJ Private Well Testing Act	EFP020
Field Operations	Field Sampling Coordinates by GPS	EFP021
Field Operations	Sampling Drinking Water Wells for Volatile Organics	EFP022
Field Operations	Sampling Drinking Water Wells for Metals	EFP023
Field Operations	Sampling Drinking Water Wells for Nitrates & Nitrites	EFP024
Field Operations	Sampling Drinking Water Wells for Gross Alpha	EFP025
Field Operations	Sampling Drinking Water Wells for Coliform Bacteria	EFP026
Field Operations	Sampling Drinking Water Wells for pH	EFP027
Field Operations	Documentation Requirements for Field Services	EFP028
Field Operations	Field Oxidation-Reduction Potential	EFP029
Field Operations	Turbidity, Field Test	EFP030
Field Operations	Analysis for Dissolved Oxygen by DO Probe	EFP031
Field Operations	Field pH in Water by Electrode	EFP032
Field Operations	Field Measurement of Specific Conductance and Resistivity	EFP033
Health & Safety	Contamination Avoidance Procedure	EHS001
Health & Safety	Measuring Face Velocities in Laboratory Fume Hoods	EHS002
Health & Safety	Proper Handling of Compressed Gas Cylinders	EHS003
Health & Safety	Sample and Waste Disposal (Formerly ESM003)	EHS004
Health & Safety	Handling and Management of Inorganic Wastes (Formerly EGN265)	EHS005
Health & Safety	Handling, Treatment, and Disposal of Foreign Soils	EHS006
Health & Safety	Management of Industrial Product Samples	EHS007
Health & Safety	Organic Prep Air Monitoring	EHS008
Information Tech	Information Security & Integrity Procedure	EMI001
Information Tech	Procedures for Requesting Software or Software Revisions	EMI002
Information Tech	Development, Implementation, Delivery, & Revision of EDDs	EMI003
Information Tech	Data Systems Maintenance and Information Handling	EMI006
Metals Analysis	Mercury Analysis of Solid Samples: SW7471A	EMA072
Metals Analysis	Metals Waste Water ICP, EPA 200.7	EMA206
Metals Analysis	Metals: ICP Emission Spec. SW846 6010B	EMA207
Metals Analysis	Mercury Analysis of Non-Potable and Potable Water Samples	EMA215
Metals Analysis	Metals by ICP-MS: EPA 200.8	EMA216
Metals Analysis	Metals by ICP-MS: SW846 6020	EMA217
Metals Analysis	Metals by ICP Atomic Emission Spectrometry using Solid State ICP	EMA222
Metals Analysis	Metals by ICP Atomic Emission Spectrometry – EPA 200.7	EMA223
Metals Analysis	Low Level Mercury by EPA 1631	EMA224
Metals Analysis	Low Level Mercury by EPA 245.7	EMA225

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Section	Standard Operating Procedure Title	Number
Metals Prep	Digestion of DW for ICP Analysis	EMP048
Metals Prep	Non-Potable Waters Digestion For ICP/Flame Analysis	EMP070
Metals Prep	Soil Digestion For ICP Analysis	EMP073
Metals Prep	Non-Potable Water Digestion for Flame/ICP (Total & Dissolved)	EMP081
Metals Prep	Digestion Of Non-Potable Waters For Total Recoverable Metals	EMP200
Metals Prep	Metals Spiking Solution and Standards Preparation and Use	EMP202
Metals Prep	Calibration of Metals Digestion Tubes	EMP203
MetalS Prep	ICP and ICP/MS Analysis of TPPM-10 Filters	EMP207
Microbiology	Microbiological Quality Control	EMB001
Microbiology	Coliform, Total By Colilert, SM18 9223 B	EMB002
Microbiology	Total Coliform: Membrane Filtration/Fecal Coliform Confirmation.	EMB003
Microbiology	Total Plate Count SM18 9215B	EMB008
Microbiology	General Petroleum Degraders	EMB009
Microbiology	Calibration of Microbiology Coliform Collection Bottles	EMB010
Microbiology	Coliform, Fecal	EMB127
Organics-GC	Semi-Volatile Petroleum Products in H2O-NJOQA25	EGC101
Organics-GC	Dibromo-3-chloropropane & 1,2,3-Trichloropropane	EGC504
Organics-GC	Chlorinated Herbicides by GC Methylation Derivitization	EGC515
Organics-GC	Volatile Aromatics in Wastewater by EPA-602	EGC602
Organics-GC	Acrolein and Acrylonitrile by EPA 603	EGC603
Organics-GC	Pesticides & PCBs in Wastewater by EPA 608	EGC608
Organics-GC	Polyaromatic Hydrocarbons	EGC610
Organics-GC	1,2-DBE, 1,2-DB-3-CP & 1,2,3-TCP by Micro-extraction and GC	EGC8011
Organics-GC	Volatile Aromatics Halocarbons by SW8021	EGC8021B
Organics-GC	Pesticides Analysis by SW8081	EGC8081
Organics-GC	PCB Analysis SW8082	EGC8082
Organics-GC	PAHs by SW846-8100	EGC8100
Organics-GC	Herbicides by SW846 – 8151	EGC8151
Organics-GC	Conn. Total Semi-volatile Petroleum Hydrocarbons	EGCCTGRO
Organics-GC	Alcohols by Direct Aqueous Injection GC/FID SW 8015	EGCALDAI
Organics-GC	Analysis of Explosives by GC/ECD	EGCBUSACH-PPM
Organics-GC	Connecticut Extractable Petroleum Hydrocarbon Analysis	EGCCTETPH
Organics-GC	Petroleum Range Organics Analysis By GC/FID (Florida)	EGCFLPRO
Organics-GC	Massachusetts Extractable Petroleum Hydrocarbons	EGCMAEPH
Organics-GC	Massachusetts Volatile Petroleum Hydrocarbons	EGCMAVPH
Organics-GC	New Jersey Extractable Petroleum Hydrocarbons	EGCNJEPH
Organics-GC	Oil Identification by Gas Chromatography Fingerprint	EGCOILID
Organics-GC	Diesel Range Organics by SW8015	EGCTPHS
Organics-GC	Gasoline Range Organics by SW8015	EGCTPHV
Organics-GC	Texas Total Petroleum Hydrocarbons	EGCTX1005
Organics-GC	Wisconsin Diesel Range Organics	EGCWIDRO
Organics-GC	Wisconsin Gasoline Range Organics	EGCWIGRO

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Section	Standard Operating Procedure Title	Number
Organics-GC/MS	Volatile Organics in Drinking Water by EPA 524	EMS524
Organics-GC/MS	Volatile Organics in Wastewater by EPA 624	EMS624
Organics-GC/MS	Semi-Volatile Organics by EPA 625	EMS625
Organics-GC/MS	Volatile Organics by SW8260B	EMS8260B
Organics-GC/MS	Ethylene/Propylene Glycol Analysis DAI-GC/MS(SIM)	EMS8260DAI
Organics-GC/MS	Semi-Volatile Organics by SW8270	EMS8270
Organics Prep	Prep of Base Neutral/Acid Extractables: Water Matrices	EOP001
Organics Prep	Prep of Base Neutrals/Acid Extractables in Solids	EOP002
Organics Prep	Alumina Cleanup of Organic Extracts: SW3610	EOP005
Organics Prep	Continuous Liquid/Liquid Extraction Water: SW3520C	EOP007
Organics Prep	Sulfur Cleanup of Organic Extracts: SW846 3660B	EOP011
Organics Prep	Testing & Approval Of Organics Solvents	EOP013
Organics Prep	Preparation & Use of MDL Check Solution	EOP014
Organics Prep	Preparation of Petroleum Oils & Organic Wastes for PCBs by SW 8082	EOP017
Organics Prep	Removal of Sulfur from Extracts with Tetrabutylammonium Sulfite	EOP018
Organics Prep	Soxhlet Extraction of Solids For Semi-Volatile Organics	EOP020
Organics Prep	Preparation of Petroleum Products for EPA 8081	EOP021
Organics Prep	Preparation of Petroluem Products for BNA by EPA 8270C	EOP022
Organics Prep	Preparation for Aqueous DRO for Wisconsin	EOP023
Organics Prep	Solvent Extraction for Soil/Sediment DRO for Wisconsin	EOP024
Organics Prep	Pressurized Fluid Extraction (ASE) SW846-3545	EOP040
Organics Prep	Alumina Column Cleanup SW3611	EOP3611
Organics Prep	Florisil Column Cleanup SW3620	EOP3620
Organics Prep	Silica Gel Cleanup SW3630	EOP3630
Organics Prep	Acid Base Partitioning SW3650	EOP3650
Organics Prep	Sulfuric Acid/Permanganate Cleanup SW3665	EOP3665
Organics Prep	Purge-And-Trap Extraction Of Aqueous Samples	EOP5030
Organics Prep	Collection/Preservation of Solids for VO Analysis: 5035	EOP5035
Organics Prep	Cleanup of Organic Extracts by Gel Permeation Chromatography	EOPGPC
Organics - LC	PAHs By HPLC Using SW-846 Method 8310	ELC8310
Project Mgmt	Procedure For The Management Of Client Projects	EPM001
Project Mgmt	Client Specific Method Modifications	EPM002
Project Mgmt	Procedure For The Notification Of DW Exceedences	EPM003
Project Mgmt	Data Entry for Sample Log-In	EPM004
Quality Assurance	Preparation, Approval, Distribution & Archiving of SOPs	EQA001
Quality Assurance	Calibration of Analytical Balances	EQA002
Quality Assurance	Calibration of Thermometers	EQA003
Quality Assurance	Calibration and Use of Auto-Pipettes	EQA004
Quality Assurance	Temperature Monitoring-	EQA005
Quality Assurance	Sample Container Cleaning & Quality Control	EQA006
Quality Assurance	Calibration of Kuderna-Danish Collection Tubes	EQA007

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Section	Standard Operating Procedure Title	Number
Quality Assurance	Preparation and Analysis of Sample Preservatives	EQA008
Quality Assurance	Personnel Training and Analyst Proficiency	EQA009
Quality Assurance	Sample Batching Procedure	EQA010
Quality Assurance	Corrective Action Procedure	EQA011
Quality Assurance	Glassware Preparation For Inorganic Lab Use	EQA012
Quality Assurance	Preparation Of Glassware For Organics Extraction	EQA013
Quality Assurance	Standards Traceability Documentation Procedure	EQA014
Quality Assurance	Template for Standard Operating Procedures	EQA016
Quality Assurance	Management/Reporting Of Proficiency Test (PT) Samples	EQA017
Quality Assurance	Creating/Distributing/Tracking Internal Chains Of Custody	EQA018
Quality Assurance	Creating New Accounts	EQA019
Quality Assurance	Creating New Projects	EQA020
Quality Assurance	Creating Product Codes	EQA021
Quality Assurance	Procedures For The Purchase Of Laboratory Supplies	EQA023
Quality Assurance	Control & Archiving Of Laboratory Documents	EQA025
Quality Assurance	Confidentiality Protection Procedures	EQA027
Quality Assurance	Quality System Review	EQA028
Quality Assurance	Contract Review	EQA029
Quality Assurance	Procedure for the Development and Application of MDLs and RLs	EQA030
Quality Assurance	Subcontracting Procedures	EQA031
Quality Assurance	Signature Authority	EQA032
Quality Assurance	Review of Inorganic Data	EQA034
Quality Assurance	Review of Organic Data	EQA035
Quality Assurance	Documentation of Equipment Maintenance	EQA036
Quality Assurance	Procedures for Accepting Departures from Laboratory Specifications	EQA037
Quality Assurance	Client Complaints Resolution Procedure	EQA038
Quality Assurance	Employee Technical Ethics Responsibilities	EQA039
Quality Assurance	Internal Audit Procedure	EQA041
Quality Assurance	Procedure for Obtaining Representative Sample Aliquots	EQA042
Quality Assurance	Procedure for Development &use of In-House Q C Criteria	EQA043
Quality Assurance	Manual Integration of Chromatographic Peaks	EQA044
Quality Assurance	Deionized Water Quality Control	EQA046
Quality Assurance	Management and Control of Change	EQA047
Quality Assurance	Laboratory Equipment Purchase and Removal From Service	EQA048
Quality Assurance	Calibration of Microliter Syringes	EQA049
Quality Assurance	Autosampler Vial Labeling Procedure (formally EOP041-01)	EQA050
Quality Assurance	pH for Volatile Samples	EQA051
Quality Assurance	Semivolatile Spike Solution Accuracy Verification	EQA053
Quality Assurance	Quality Control Review of Data Packages	EQA054
Quality Assurance	Procedures for Determining Method Comparability	EQA055
Quality Assurance	Refrigerator Storage Holding Blank Procedure	EQA056
Quality Assurance	Data Integrity Training Procedure	EQA057
Quality Assurance	Data Integrity Monitoring Procedure	EQA058
Quality Assurance	Procedure for Conducting Data Integrity Investigations	EQA059
Quality Assurance	Procedure for the Confidential Reporting of Data Integrity Issues	EQA061
Quality Assurance	Calibration of Volumetric Dispensers for Volume Critical Processes	EQA062

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Section	Standard Operating Procedure Title	Number
Quality Assurance	Calibration of Volumetric Dispensers / Non-Critical Volumes Processes	EQA063
Quality Assurance	Glassware Preparation for use in VOA analysis	EQA064
Quality Assurance	Control of Non-Conforming Product	EQA065
Quality Assurance	Client Notification of Key Personnel Changes	EQA066
Quality Assurance	Review of Inorganic Notebooks	EQA067
Quality Assurance	Disposal of Spent Semi-Volatile Organic Extracts	EQA068
Quality Assurance	Compressed Gas Management	EQA069
Quality Assurance	Procedure for Tracking Quality Control Non-Conformances	EQA070
Report Generation	New Jersey DEP Contract Compliane Screening	ERG001
Report Generation	Report Generation–Data Package	ERG002
Sample Mgmt.	Sample Storage	ESM001
Sample Mgmt.	Chain Of Custody And Log In Procedure	ESM002
Sample Mgmt.	Temperature Maintenance Of Shipping Coolers	ESM004
Sample Mgmt.	Cooler Packaging And Shipping Procedure	ESM008
Sample Mgmt.	Procedures for Sample Couriers	ESM011
Sample Mgmt.	Summa Canister Shipment & Retrieval: NJDEP 03-X-35135	ESM012

Appendix III

Analytical Capabilities

Method Capabilities by NELAC Accredited Fields of Testing

Analytes	Method Number	Program	Chemistry Field
Alkalinity	SM 2320 B	Drinking Water	Inorganic Analysis
Ammonia	SM 4500-NH_3 H	Drinking Water	Inorganic Analysis
Chloride, Fluoride, Sulfate	EPA 300.0	Drinking Water	Inorganic Analysis
Chlorine, Total Residual	SM 4500-CL F	Drinking Water	Inorganic Analysis
Color, Apparent	SM 2120 B	Drinking Water	Inorganic Analysis
Conductivity	SM 2510 B	Drinking Water	Inorganic Analysis
Cyanide	EPA 335.4	Drinking Water	Inorganic Analysis
Foaming Agents (MBAS)	SM 5540 C	Drinking Water	Inorganic Analysis
Nitrate/Nitrite	EPA 353.2	Drinking Water	Inorganic Analysis
Nitrite	SM 4500-NO_2 B	Drinking Water	Inorganic Analysis
Odor	SM 2150 B	Drinking Water	Inorganic Analysis
Organic Carbon, Total (TOC)	SM 5310 B	Drinking Water	Inorganic Analysis
Orthophosphate	SM 4500-P E	Drinking Water	Inorganic Analysis
Perchlorate	EPA 314.0	Drinking Water	Inorganic Analysis
pH, Hydrogen Ion	SM 4500-H^+ B	Drinking Water	Inorganic Analysis
Silica, Dissolved	SM 4500-Si D	Drinking Water	Inorganic Analysis
Temperature	SM 2550 B	Drinking Water	Inorganic Analysis
Total Dissolved Solids	SM 2540 C	Drinking Water	Inorganic Analysis
Total Organic Halides (TOX)	SM 5320 B	Drinking Water	Inorganic Analysis
Turbidity	EPA 180.1	Drinking Water	Inorganic Analysis
Hardness, Calcium	EPA 200.7	Drinking Water	Metals Analysis
Hardness, Total	EPA 200.7	Drinking Water	Metals Analysis
Hardness, Total	SM 2340 C	Drinking Water	Metals Analysis
Mercury	EPA 245.1	Drinking Water	Metals Analysis
Metals	EPA 200.7	Drinking Water	Metals Analysis
Metals	EPA 200.8	Drinking Water	Metals Analysis
Chlorinated Herbicides	EPA 515.1	Drinking Water	Organics Analysis
DBCP, EDB & TCP	EPA 504.1	Drinking Water	Organics Analysis
Volatile Organics	EPA 524.2	Drinking Water	Organics Analysis
Total Coliform/E. Coli	SM 9223 B	Drinking Water	Microbiology
Heterotrophic Bacteria	SM 9215 B	Drinking Water	Microbiology
Acidity as $CaCO_3$	SM 2310 B (4A)	Wastewater	Inorganic Analysis
Alkalinity as $CaCO_3$	SM 2320 B	Wastewater	Inorganic Analysis
Ammonia	SM20 4500-NH_3-B+G	Wastewater	Inorganic Analysis
Biochemical Oxygen Demand	SM 5210 B	Wastewater	Inorganic Analysis
Bromide, Chloride, Fluoride, Sulfate	EPA 300.0	Wastewater	Inorganic Analysis

Method Capabilities by NELAC Accredited Fields of Testing

Analytes	Method Number	Program	Chemistry Field
Carbonaceous BOD (CBOD)	SM 5210 B	Wastewater	Inorganic Analysis
Chemical Oxygen Demand (COD)	SM 5220 C	Wastewater	Inorganic Analysis
Chloride	SM 4500-Cl C	Wastewater	Inorganic Analysis
Chlorine, Total Residual	SM 4500-Cl F	Wastewater	Inorganic Analysis
Chromium (VI)	SM 3500-Cr D	Wastewater	Inorganic Analysis
Chromium (VI)	EPA 218.6	Wastewater	Inorganic Analysis
Color, Apparent	SM 2120 B	Wastewater	Inorganic Analysis
Cyanide (Sample Preparation)	SM 4500-CN C+E	Wastewater	Inorganic Analysis
Cyanide (Analytical Finish)	EPA 335.4	Wastewater	Inorganic Analysis
Cyanide Amenable to Chlorine	SM 4500-CN C+G	Wastewater	Inorganic Analysis
Hardness, Total as $CaCO_3$	SM 2340 B or C	Wastewater	Inorganic Analysis
Iron, Ferrous	SM 4500-Fe D	Wastewater	Inorganic Analysis
Kjeldahl Nitrogen, Total	EPA 351.2	Wastewater	Inorganic Analysis
Nitrate/Nitrite	EPA 353.2	Wastewater	Inorganic Analysis
Nitrite	SM 4500-NO_2 B	Wastewater	Inorganic Analysis
Oil & Grease, HEM-LL	EPA 1664A	Wastewater	Inorganic Analysis
Oil & Grease, SGT-HEM, Non-Polar	EPA 1664A	Wastewater	Inorganic Analysis
Organic Nitrogen	SM 4500-N B+G	Wastewater	Inorganic Analysis
Orthophosphate	SM 4500-P E	Wastewater	Inorganic Analysis
Oxygen, Dissolved	SM 4500-O C	Wastewater	Inorganic Analysis
Oxygen, Dissolved	SM 4500-O G	Wastewater	Inorganic Analysis
pH Hydrogen Ion	SM 4500-H^+ B	Wastewater	Inorganic Analysis
Phenols	EPA 420.1+420.4	Wastewater	Inorganic Analysis
Phenols (Analytical Finish)	SW846 9066	Wastewater	Inorganic Analysis
Phosphorus (Total)	EPA 365.3	Wastewater	Inorganic Analysis
Residue, Filterable (TDS)	SM 2540 C	Wastewater	Inorganic Analysis
Residue, Nonfilterable (TSS)	SM 2540 D	Wastewater	Inorganic Analysis
Residue, Settlable	SM 2540 F	Wastewater	Inorganic Analysis
Residue, Total	SM 2540 B	Wastewater	Inorganic Analysis
Residue, Volatile	EPA 160.4	Wastewater	Inorganic Analysis
Total, fixed, and volatile solids (SQAR)	SM 2540 G, 18th Ed.	Wastewater	Inorganic Analysis
Salinity	SM 2520 B	Wastewater	Inorganic Analysis
Silica, Dissolved	SM 4500-Si D	Wastewater	Inorganic Analysis
Specific Conductance	SM 2510 B	Wastewater	Inorganic Analysis
Specific Conductance	SW846 9050A	Wastewater	Inorganic Analysis
Sulfide (S)	SM 4500-S E or F	Wastewater	Inorganic Analysis
Sulfite (SO_3)	SM 4500-SO_3 B	Wastewater	Inorganic Analysis
Surfactants (Methylene Blue)	SM 5540 C	Wastewater	Inorganic Analysis
Temperature	SM 2550 B	Wastewater	Inorganic Analysis
Total Organic Carbon (TOC)	SM 5310 B, C or D	Wastewater	Inorganic Analysis
Total Organic Halides (TOX)	SW846 9020B	Wastewater	Inorganic Analysis

Method Capabilities by NELAC Accredited Fields of Testing

Analytes	Method Number	Program	Chemistry Field
Turbidity	EPA 180.1	Wastewater	Inorganic Analysis
Metals, Total – Water	SW846 3010A	Wastewater	Metals Prep
Metals, Total – Water, Rec. + Dissolved	SW846 3005A	Wastewater	Metals Prep
Hardness, Total as $CaCO_3$	EPA 200.7	Wastewater	Metals Analysis
Hardness, Total as $CaCO_3$	SM 2340 B or C	Wastewater	Metals Analysis
Mercury	EPA 245.1	Wastewater	Metals Analysis
Metals, ICP	EPA 200.7	Wastewater	Metals Analysis
Metals, ICP/MS	EPA 200.8	Wastewater	Metals Analysis
Mercury, Low-Level	EPA 245.7	Wastewater	Metals Analysis
Mercury, Low-Level	EPA 1631E	Wastewater	Metals Analysis
Mercury, Liquid Waste	SW846 7470A	Wastewater	Metals Analysis
Acrolein & Acrylonitrile	EPA 603	Wastewater	Organics Analysis
Base/Neutrals and Acids	EPA 625	Wastewater	Organics Analysis
Extractable Petroleum Hydrocarbons	NJDEP EPH	Wastewater	Organics Analysis
Organochlorine Pests & PCBs	EPA 608	Wastewater	Organics Analysis
Petroleum Hydrocarbons	NJ-OQA-QAM-25	Wastewater	Organics Analysis
Purgeable Aromatics	EPA 602	Wastewater	Organics Analysis
Volatile Organics	EPA 624	Wastewater	Organics Analysis
Coliform, Fecal (Count per 100 mL)	SM 9222 D	Wastewater	Microbiology
Coliform, Total (Count per 100 mL)	SM 9222 B	Wastewater	Microbiology
Heterotrophic Plate Count	SM 9215 B	Wastewater	Microbiology
Acid Soluble/Insoluble Sulfides	SW846 9034	Solid/Haz. Waste	Inorganic Analysis
Bomb Calorimetry	ASTM D-240	Solid/Haz. Waste	Inorganic Analysis
Bromide, Chloride, Fluoride, Sulfate	SW846 9056	Solid/Haz. Waste	Inorganic Analysis
Cation, Exchange Capacity	SW846 9081	Solid/Haz. Waste	Inorganic Analysis
Chromium (VI) Digestion	SW846 3060A	Solid/Haz. Waste	Inorganic Analysis
Chromium (VI)	SW846 7196A	Solid/Haz. Waste	Inorganic Analysis
Chromium (VI)	SW846 7199	Solid/Haz. Waste	Inorganic Analysis
Corrosivity/pH, >20% H2O	SW846 9040C	Solid/Haz. Waste	Inorganic Analysis
Cyanide	SW846 9010B	Solid/Haz. Waste	Inorganic Analysis
Cyanide, Amenable to Chlorine	SW846 9010B	Solid/Haz. Waste	Inorganic Analysis
Cyanide	SW846 9012B	Solid/Haz. Waste	Inorganic Analysis
Extractable Organic Halides	SW846 9023	Solid/Haz. Waste	Inorganic Analysis
Free Liquid	SW846 9095	Solid/Haz. Waste	Inorganic Analysis
Ignitability	SW846 1010A	Solid/Haz. Waste	Inorganic Analysis
Oil & Grease, HEM	EPA 1664A	Solid/Haz. Waste	Inorganic Analysis

Method Capabilities by NELAC Accredited Fields of Testing

Analytes	Method Number	Program	Chemistry Field
Oil & Grease and Sludge, HEM	SW846 9071B	Solid/Haz. Waste	Inorganic Analysis
pH, Hydrogen Ion	SW846 9040C	Solid/Haz. Waste	Inorganic Analysis
pH, Hydrogen Ion, Waste, >20% Water	SW846 9040C	Solid/Haz. Waste	Inorganic Analysis
pH, Soil and Waste	SW846 9045C	Solid/Haz. Waste	Inorganic Analysis
Phenols (Sample Preparation)	SW846 9065	Solid/Haz. Waste	Inorganic Analysis
SPLP Metals/Organics	SW846 1312	Solid/Haz. Waste	Inorganic Analysis
TCLP Metals/Semi Volatile Organics	SW846 1311	Solid/Haz. Waste	Inorganic Analysis
TCLP Volatile Organics	SW846 1311	Solid/Haz. Waste	Inorganic Analysis
Total Organic Carbon (TOC)	SW846 9060 A	Solid/Haz. Waste	Inorganic Analysis
Metals, Solids	SW846 3050B	Solid/Haz. Waste	Metals Prep
Mercury, Solid Waste	SW846 7471A	Solid/Haz. Waste	Metals Analysis
Metals by ICP	SW846 6010B	Solid/Haz. Waste	Metals Analysis
Metals by ICP/MS	SW846 6020	Solid/Haz. Waste	Metals Analysis
Semivolatiles, Acid/Base Partition	SW846 3650B	Solid/Haz. Waste	Organics Prep
Semivolatiles, Alumina Cleanup	SW846 3610B	Solid/Haz. Waste	Organics Prep
Semivolatiles, Alumina Cleanup (Petro)	SW846 3611B	Solid/Haz. Waste	Organics Prep
Semivolatiles, Florisil Cleanup	SW846 3620B	Solid/Haz. Waste	Organics Prep
Semivolatiles, Gel Permeation Cleanup	SW846 3640A	Solid/Haz. Waste	Organics Prep
Semivolatiles, Silica Gel Cleanup	SW846 3630C	Solid/Haz. Waste	Organics Prep
Semivolatiles, Sulfur Cleanup	SW846 3660B	Solid/Haz. Waste	Organics Prep
Semivolatiles, Sulfuric Acid/MnO_2	SW846 3665A	Solid/Haz. Waste	Organics Prep
Semivolatile Prep, Pressurized Fluid	SW846 3545	Solid/Haz. Waste	Organics Prep
Semivolatile Prep, Waste Dilution	SW846 3580A	Solid/Haz. Waste	Organics Prep
Semivolatile Prep Solid, Sonication	SW846 3550B	Solid/Haz. Waste	Organics Prep
Semivolatile Prep Solids, Soxhlet	SW846 3540C	Solid/Haz. Waste	Organics Prep
Semivolatile Prep Water	SW846 3520C	Solid/Haz. Waste	Organics Prep
Semivolatile Prep Water	SW846 3510C	Solid/Haz. Waste	Organics Prep
Volatile, Headspace	SW846 3810	Solid/Haz. Waste	Organics Prep
Volatile, Purge & Trap, Solids–High	SW846 5035H	Solid/Haz. Waste	Organics Prep
Volatile, Purge & Trap, Solids–Low	SW846 5035L	Solid/Haz. Waste	Organics Prep
Volatile, Purge & Trap, Water	SW846 5030B	Solid/Haz. Waste	Organics Prep
Alcohols	SW846 8015B	Solid/Haz. Waste	Organics Analysis
Aromatic/Halogenated Volatile	SW846 8021B	Solid/Haz. Waste	Organics Analysis
Base/Neutrals and Acids	SW846 8270C	Solid/Haz. Waste	Organics Analysis
Chlorinated Herbicides	SW846 8151A	Solid/Haz. Waste	Organics Analysis
DBCP, EDB & TCP	SW846 8011	Solid/Haz. Waste	Organics Analysis
Diesel Range Organic	SW846 8015B	Solid/Haz. Waste	Organics Analysis

Method Capabilities by NELAC Accredited Fields of Testing

Analytes	Method Number	Program	Chemistry Field
Dissolved Gas/Aqueous Media	RSK-175	Solid/Haz. Waste	Organics Analysis
Ethylene Glycol & Propylene Glycol	SW846 8260B	Solid/Haz. Waste	Organics Analysis
Extractable Petroleum Hydrocarbons	NJDEP EPH	Solid/Haz. Waste	Organics Analysis
Gasoline Range Organic	SW846 8015B	Solid/Haz. Waste	Organics Analysis
Organochlorine Pesticides	SW846 8081	Solid/Haz. Waste	Organics Analysis
PCBs	SW846 8082	Solid/Haz. Waste	Organics Analysis
Petroleum Hydrocarbons	NJ-OQA-QAM-25	Solid/Haz. Waste	Organics Analysis
Polynuclear Aromatic HCs	SW846 8100	Solid/Haz. Waste	Organics Analysis
Polynuclear Aromatic HCs	SW846 8310	Solid/Haz. Waste	Organics Analysis
Volatile Organics	SW846 8260B	Solid/Haz. Waste	Organics Analysis
Volatile Organics	EPA TO- 3	Clean Air Act	Organics Analysis
Volatile Organics	EPA TO-15	Clean Air Act	Organics Analysis

Method Capabilities—Non-NELAC Methods

Analytes	Method Number	Program	Chemistry Field
Phenols	EPA 420.4	Drinking Water	Inorganic Analysis
Carbon Dioxide	SM 4500-CO_2 C or D	Wastewater	Inorganic Analysis
Iodide	SM 4500-I B	Wastewater	Inorganic Analysis
Iodine	SM 4500-I B	Wastewater	Inorganic Analysis
Nonionic Surfactants as CTAS	SM 5540 D	Wastewater	Inorganic Analysis
Particulate Matter	EPA 160.2M	Wastewater	Inorganic Analysis
Petroleum Hydrocarbons	EPA 418.1	Wastewater	Inorganic Analysis
Phosphorus, Hydrolyzable	EPA 365.3	Wastewater	Inorganic Analysis
Redox Potential vs H^+	ASTM D1498-76	Wastewater	Inorganic Analysis
Specific Gravity	ASTM D1298-85	Wastewater	Inorganic Analysis
Total Organic Content	ASTM D2974-87	Wastewater	Inorganic Analysis
Unburned Combustibles	EPA 160.1+160.4	Wastewater	Inorganic Analysis
Viscosity	ASTM D445/6	Wastewater	Inorganic Analysis
Volatile Suspended Solids	EPA 160.2+160.4	Wastewater	Inorganic Analysis
Weak Acid Dissociable Cyanide Prep	SM 4500-CN I	Wastewater	Inorganic Analysis
Ammonia	EPA 350.1M	Solid/Haz. Waste	Inorganic Analysis
Ammonia	EPA 350.2M	Solid/Haz. Waste	Inorganic Analysis
Base Sediment	ASTM D473-81	Solid/Haz. Waste	Inorganic Analysis
Bulk Density (Dry Basis)	ASTM D2937-94M	Solid/Haz. Waste	Inorganic Analysis
Chemical Oxygen Demand	HACH 8000M	Solid/Haz. Waste	Inorganic Analysis
Chloride	EPA 325.3M	Solid/Haz. Waste	Inorganic Analysis
Combustion, Bomb Oxidation	SW846 5050	Solid/Haz. Waste	Inorganic Analysis
Grain Size & Sieve Testing	ASTM D422-63	Solid/Haz. Waste	Inorganic Analysis
Heat Content, BTU	ASTM D3286-85	Solid/Haz. Waste	Inorganic Analysis
Ignitability (Flashpoint)	ASTM D93-90/SW846 Ch 7	Solid/Haz. Waste	Inorganic Analysis
Multiple Extractions	SW846 1320	Solid/Haz. Waste	Inorganic Analysis
Neutral Leaching Procedure	ASTM D3987-85	Solid/Haz. Waste	Inorganic Analysis
Nitrate/Nitrite	EPA 353.2M	Solid/Haz. Waste	Inorganic Analysis
Organic Matter (Ignition Loss)	AASHTO T267-86M	Solid/Haz. Waste	Inorganic Analysis
Orthophosphate	EPA 365.2M	Solid/Haz. Waste	Inorganic Analysis
Percent Ash (Dry Basis)	ASTM D482-91	Solid/Haz. Waste	Inorganic Analysis
Percent Solids	ASTM D4643-00	Solid/Haz. Waste	Inorganic Analysis
Percent Sulfur	ASTM D129-61	Solid/Haz. Waste	Inorganic Analysis
Petroleum Hydrocarbons	EPA 418.1M	Solid/Haz. Waste	Inorganic Analysis
Phosphorus, Total	EPA 365.3M	Solid/Haz. Waste	Inorganic Analysis
Phosphorus, Hydrolyzable	EPA 365.3M	Solid/Haz. Waste	Inorganic Analysis
Pour Point	ASTM D97-87	Solid/Haz. Waste	Inorganic Analysis
Reactive Cyanide	SW846 7.3.3.2	Solid/Haz. Waste	Inorganic Analysis

Method Capabilities—Non-NELAC Methods

Analytes	Method Number	Program	Chemistry Field
Reactive Sulfide	SW846 7.3.4.2	Solid/Haz. Waste	Inorganic Analysis
Redox Potential vs H^+	ASTM D1498-76M	Solid/Haz. Waste	Inorganic Analysis
Specific Gravity of Solids	ASTM D1429-86M	Solid/Haz. Waste	Inorganic Analysis
Sulfide (S)	EPA 376.1 M	Solid/Haz. Waste	Inorganic Analysis
Sulfite (SO_3)	EPA 377.1M	Solid/Haz. Waste	Inorganic Analysis
Total Chlorine	ASTM D808-91	Solid/Haz. Waste	Inorganic Analysis
Total Kjeldahl Nitrogen	EPA 351.2M	Solid/Haz. Waste	Inorganic Analysis
Total Organic Carbon	CORP ENG 81	Solid/Haz. Waste	Inorganic Analysis
Total Organic Carbon	LLOYD KAHN 1988	Solid/Haz. Waste	Inorganic Analysis
Total Organic Chlorine	ASTM D808-91M	Solid/Haz. Waste	Inorganic Analysis
Total Plate Count	SM 9215BM	Solid/Haz. Waste	Inorganic Analysis
Total Volatile Solids	EPA 160.4M	Solid/Haz. Waste	Inorganic Analysis
Water Content	ASTM D95-83	Solid/Haz. Waste	Inorganic Analysis
Extractable Petroleum HCs	Massachusetts EPH	Solid/Haz. Waste	Organics Analysis
Extractable Petroleum HCs	Missouri DRO	Solid/Haz. Waste	Organics Analysis
Total Petroleum Hydrocarbons	FLDEP FL-PRO	Solid/Haz. Waste	Organics Analysis
Total Petroleum Hydrocarbons	Connecticut ETPH	Solid/Haz. Waste	Organics Analysis
Volatile Petroleum HCs	Massachusetts VPH	Solid/Haz. Waste	Organics Analysis
Volatile Petroleum HCs	Missouri GRO	Solid/Haz. Waste	Organics Analysis

Appendix IV

Laboratory Equipment

Equipment	Manufacture & Description	Serial Number	Operating System Software	Data Processing Software	Location	Purchase
ASE	Dionex ASE 200	99040595	None	None	Organic Prep	1999
ASE	Dionex ASE 200	99040603	None	None	Organic Prep	1999
ASE	Dionex ASE 200	03040695	None	None	Organic Prep	2005
ASE	Dionex ASE 200	99030375	None	None	Organic Prep	1999
ASE	Dionex ASE 200	99030375	None	None	Inorganics	1999
Balance-Top Load	Ohaus TS400D (B-3)	1330	None	None	Organic Prep	Pre-2000
Balance-Top Load	Ohaus Scout (B-4)	BJ046417	None	None	Sample Management	2001
Balance-Top Load	Ohaus E400 (B-6)	8714	None	None	Out of service	Pre-2000
Balance-Top Load	Ohaus Navigator (B-7)	1121370265	None	None	Organic Prep	2002
Balance-Top Load	Ohaus TS400S (B-9)	2475	None	None	Extra	2000
Balance-Top Load	Ohaus GT4100 (B-11)	3202	None	None	Extra	Pre-2000
Balance-Top Load	Sartorious B4100 (B-13)	38080035	None	None	Inorganics	Pre-2000
Balance-Top Load	Denver Inst. Co. XL500 (B-14)	B045530	None	None	Inorganics	Pre-2000
Balance-Top Load	Ohaus Navigator (B-15)	121370273	None	None	Inorganics	2002
Balance-Top Load	Ohaus Explorer (B-16)	E1581119212171	None	None	Inorganics	2001
Balance-Top Load	Ohaus Navigator (B-17)	11192639994	None	None	Out of service	2001

Equipment	Manufacture & Description	Serial Number	Operating System Software	Data Processing Software	Location	Purchase
Balance-Top Load	Ohaus Navigator (B-18)	1119323138	None	None	Out of service	2001
Balance-Top Load	Ohaus Scout II (B-19)	BJ514783	None	None	Out of service	2002
Balance-Top Load	Ohaus Scout II (B-20)	BJ320905	None	None	Methanol Prep	2002
Balance-Top Load	Ohaus Adventurer (B-21)	E1021218270448	None	None	Inorganics	2001
Balance-Top Load	Ohaus Scout II (B-25)	BJ514770	None	None	Methanol Prep	2004
Balance-Top Load	Ohaus Adventurer AR3130 (B-26)	1240-P	None	None	Metals Prep	2004
Balance-Top Load	Ohaus Adventurer AV412 (B-27)	8026251106	None	None	Inorganics	2005
Balance-Top Load	Ohaus Sport (B-28)	7124230518	None	None	Organics; Volatiles	2005
Balance-Top Load	Ohaus Adventurer AV412 (B-29)	8026391019	None	None	Out of service	2005
Balance-Top Load	Ohaus Adventurer AV412 (B-30)	8026391160	None	None	Screen	2005
Balance-Top Load	Ohaus Adventurer AV412 (B-31)	8028041080	None	None	Organic Prep	2007
Balance-Top Load	Sartorius TE31025 (B-32)	21950273	None	None	Inorganics	2007
Balance-Top Load	Ohaus Adventure AV412 (B-33)	8028391184	None	None	Sample Management	2007
Balance-Top Load	Ohaus Adventure AV412 (B-34)	8028391117	None	None	Organics; Volatiles	2007
Balance-Top Load	Ohaus Adventure AV212 (B-35)	8029171184	None	None	Inorganics	2008
Balance-Top Load	Ohaus Adventure AV212 (B-36)	8029131104	None	None	IC Lab	2008
Balance-Top Load	Ohaus Adventure AV412 (B-37)	802916112	None	None	Organic Prep	2008

Equipment	Manufacture & Description	Serial Number	Operating System Software	Data Processing Software	Location	Purchase
Balance-Top Load	Ohaus Adventurer-Pro (B-38)	8030441010	None	None	Inorganics	2009
Balance-Analytical	Mettler AE 160 (B-5)	C11620	None	None	Inorganics	1999
Balance-Analytical	ACCU LA 110 (B-10)	70405919	None	None	Out of service	2001
Balance-Analytical	Ohaus Adventurer (B-24)	1225032523P	None	None	Inorganics	2004
Balance-Top Load	Denver P-214 (B-39)	25450279	None	None	Inorganics	2010
Balance-Top Load	Denver P-214 (B-40)	25550445	None	None	Inorganics	2010
Balance-Top Load	Ohaus Adventure AV412 (B-41)	8031331120	None	None	Inorganics	2010
Balance-Top Load	Ohaus Adventure AV412 (B-42)	8031331113	None	None	Inorganics	2010
Calorimeter	PARR 1261EA	1499	None	None	Inorganics	1996
DO Meter	YSI 5000	07B1560	None	None	Inorganics	2008
DO Meter	YSI-50B	91L034801	None	None	Inorganics	1988
DO Meter	YSI-51B	92A035818	None	None	Field Serv.	1998
DO Meter	YSI-55/12ft	00C0598BG	None	None	Field Serv.	2000
FIA Analyzer	Lachat Quikchem 8000	A83000-2273	Omnion FIA	Omnion FIA	Inorganics	2004
FIA Analyzer	Lachat Quikchem 8000	A83000-1402	Omnion FIA	Omnion FIA	Inorganics	1999
Flashpoint	Koehler – K16200	R07002563B	None	None	Inorganics	2010
GC-2G (I)	Agilent Technologies 6890N / 7683	CN10450110	HP Chemstation	HP Enviroquant	Organics; SVOCs	2005

Equipment	Manufacture & Description	Serial Number	Operating System Software	Data Processing Software	Location	Purchase
GC-2Y/2Z	Agilent Technologies 6890N & N10149	CN10407032 / CN40327643 / CN40434847	HP Chemstation	HP Enviroquant	Organics; SVOCs	2004
GC-3G (J)	Agilent Technologies 6890N / 7683	CN10450109	HP Chemstation	HP Enviroquant	Organics; SVOCs	2005
GC-3Y/3Z	Agilent Technologies 7890A / 7683B Dual FID	CN10735014 / CN73345070	HP Chemstation	HP Enviroquant	Organics; SVOCs	2007
GC-4G	Agilent Technologies 6890N / 7693	CN10361136 / CN10340093	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GC-4Y/4Z	Agilent Technologies 7890A / 7683B Dual FID	CN10832133 / CN83252932	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GC-AA	Agilent 7890A / AS 7683B	CN10832133 / US08232002	HP Chemstation	HP Enviroquant	Organics; Volatiles	2008
GC-AB	Hewlett-Packard 5890 / Dual ECD / HP 7673 AS	2750A16635	HP Chemstation	HP Enviroquant	Organics; SVOCs	1990
GC-CD	Hewlett-Packard 5890 / Dual ECD / HP 7673 AS	3336A58788	HP Chemstation	HP Enviroquant	Organics; SVOCs	1995
GC-EF	Hewlett-Packard 5890 / Dual ECD / HP 7673 AS	2541A06786	HP Chemstation	HP Enviroquant	Organics; Volatiles	1992
GC-G1/1H	Agilent Technologies 6890N / 7683	US10322012 / CN23326744	HP Chemstation	HP Enviroquant	Organics; SVOCs	2003
GC-GH	Hewlett-Packard 5890 / Dual ECD / HP 7673 AS	2938A25059	HP Chemstation	HP Enviroquant	Organics; SVOCs	1990
GC-II	Hewlett-Packard 5890 Series II	3203A40375	HP Chemstation	HP Enviroquant	Organics; SVOCs	1994
GC-JK	Hewlett-Packard 5890 / PID / Hall / 4552 / 4560ARCHON	3336A51043	HP Chemstation	HP Enviroquant	Organics; Volatiles	1994
GC-LM	Hewlett-Packard 6890 / PID / FID / OI 4551 / 4560 P&T	US00008927	HP Chemstation	HP Enviroquant	Organics; Volatiles	1998
GC-NP	Hewlett-Packard 5890 / PID / FID / Tekmar solatek 72	3336A58858	HP Chemstation	HP Enviroquant	Organics; Volatiles	1995
GC-OA/OB	Agilent Technologies 6890N	US10240147	HP Chemstation	HP Enviroquant	Organics; SVOCs	2002
GC-QR	Hewlett Packard 5890 / PID / FID / Entech AutoAir7000	3336A51044	HP Chemstation	HP Enviroquant	Air Laboratory	1993

Equipment	Manufacture & Description	Serial Number	Operating System Software	Data Processing Software	Location	Purchase
GC-QT	Agilent Technologies 6890N	US10148124	HP Chemstation	HP Enviroquant	Organics; SVOCs	2002
GC-SC	Hewlett-Packard 5890 / FID / OI4551 / 4560	2443AO3797	HP Chemstation	HP Enviroquant	Organics; Volatiles	1990
GC-SR	Hewlett-Packard 5890 / FID / Tekmar 7000	2612A07448	HP Chemstation	HP Enviroquant	Organics; Screening	1992
GC-ST	Hewlett-Packard 5890 / FID / NPD / HP 7673 AS / Tek	314OA38871	HP Chemstation	HP Enviroquant	Organics; Volatiles	1996
GC-SV	Hewlett-Packard 5890 / FID / OI4551 / 4560	LR47-359C / N244460743 / 3336A58859	HP Chemstation	HP Enviroquant	Organics; Screening	1996
GC-SY	Hewlett-Packard 5890 / FID / OI4551A / 4560	2643A10503	HP Chemstation	HP Enviroquant	Organics; Screening	1990
GC-UV	Hewlett-Packard 5890 / Dual FID / OI 4551 / 4560	2921A23322	HP Chemstation	HP Enviroquant	Organics; SVOCs	1996
GC-WW	Hewlett-Packard 6890 / Dual ECD / HP 7673 AS	US00010037	HP Chemstation	HP Enviroquant	Organics; SVOCs	1997
GC-XX	Hewlett-Packard 6890 / Dual ECD / HP 7683 AS	US00022968	HP Chemstation	HP Enviroquant	Organics; SVOCs	1998
GC-YZ/ZZ	Hewlett-Packard 6890 / PID / FID / OI HP GC System Injector	US00011065 / US83806744	HP Chemstation	HP Enviroquant	Organics; SVOCs	1998
GCMS-1A	Agilent Technologies 5973 / 6890N AS 4551A / 4660	CN10314026 / US30945331	HP Chemstation	HP Enviroquant	Organics; Volatiles	2003
GCMS-1B	Agilent Technologies 7890A / 5975C Teledyne / Tekmar AquaTek AS	CN10845177 / US83111119	HP Chemstation	HP Enviroquant	Organics; Volatiles	2008
GCMS-1C	Agilent Technologies 5973 / 6890N AS 4551 / 4560	CN10425085 / US41746667	HP Chemstation	HP Enviroquant	Organics; Volatiles	2004
GCMS-2A	Agilent Technologies 5973 / 6890N AS Tekmar Solatek 72	CN10314028 / US30945325	HP Chemstation	HP Enviroquant	Organics; Volatiles	2003
GCMS-2B	Agilent Technologies 5973 / 6890N AS 4551A / 4660	CN10441033 / US 43146954	HP Chemstation	HP Enviroquant	Organics; Volatiles	2004
GCMS-2C	Agilent Technologies 5973 / 6890N AS 4551A / 4560	CN10441035 / US 43146953	HP Chemstation	HP Enviroquant	Organics; Volatiles	2004
GCMS-2D	Agilent Technologies 5973 / 6890N AS 4552 / 4560	CN10432038 / US43146771	HP Chemstation	HP Enviroquant	Organics; Volatiles	2004

Equipment	Manufacture & Description	Serial Number	Operating System Software	Data Processing Software	Location	Purchase
GCMS-2E	Agilent Technologies 5975 / 6890N AS 4551A / 4660	CN10612046 / US60532596	HP Chemstation	HP Enviroquant	Organics; Volatiles	2006
GCMS-2M	Agilent Technologies 5973 / 6890N AS 4552 / 12720	CN10612028 / US60532578 / CN61031719	HP Chemstation	HP Enviroquant	Organics; SVOCs	2006
GCMS-2P	Agilent Technologies 5975C / 7890A	US10237403 / CN10241022	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GCMS-2W	Agilent Technologies 5973 / 6890N AS Entech 7016CA	CN10413022 / US40646500	HP Chemstation	HP Enviroquant	Air Laboratory	2004
GCMS-3A	Agilent Technologies 5973 / 6890N AS 4551A / 4660	CN10432042 / US43146776	HP Chemstation	HP Enviroquant	Organics; Volatiles	2004
GCMS-3B	Agilent Technologies 6890 / 5973 / OI 4551A / 4660	US10240044 / US21844015	HP Chemstation	HP Enviroquant	Organics; Volatiles	2002
GCMS-3C	Agilent Technologies 5973 / 6890N AS 45551A / 4660	CN10517038 / US44621480	HP Chemstation	HP Enviroquant	Organics; Volatiles	2005
GCMS-3D	Agilent Technologies 5975B / 6890N AS 4551A / 4660	CN10637120 / US62724193	HP Chemstation	HP Enviroquant	Organics; Volatiles	2006
GCMS-3E	Agilent Technologies 5975 / 6890N Agilent 7683	CN10614011 / US61332852 / CN73943902	HP Chemstation	HP Enviroquant	Organics; SVOCs	2006
GCMS-3M	Agilent Technologies 5975B / 6890N / Agilent 7683B	US65125107 / CN10703029 / CN61933091	HP Chemstation	HP Enviroquant	Organics; SVOCs	2007
GCMS-3P	Agilent Technologies 5975C / 7890A	US83111119 / CN10361163	HP Chemstation	HP Enviroquant	Organics; SVOCs	2010
GCMS-3W	Agilent Technologies 5973 / 6890N Entech 7016A	CN10425086 / US41746669 / 1351	HP Chemstation	HP Enviroquant	Air Laboratory	2007
GCMS-4B	Agilent Technologies 5975C / 7890A	US10323601 / CN10361158	HP Chemstation	HP Enviroquant	Organics; Volatiles	2010
GCMS-4D	Agilent Technologies 5975C / 7890A	US10237301 / CN10241019	HP Chemstation	HP Enviroquant	Organics; Volatiles	2010
GCMS-4M	Agilent Technologies 5975C / 7890A Agilent 7683B	US73317574 / CN1074251 / US94209706	HP Chemstation	HP Enviroquant	Organics; SVOCs	2007
GCMS-A	Hewlett-Packard 6890 / 5973 MSD / OI 4552 / 4560 ARCHON	US00033272 / US94212183	HP Chemstation	HP Enviroquant	Organics; Volatiles	2000
GCMS-B	Hewlett-Packard 5890II+ / 5972 MSD / Agilent 7673	3336A61054 / 3524A03106	HP Chemstation	HP Enviroquant	Organics; SVOCs	1996

Equipment	Manufacture & Description	Serial Number	Operating System Software	Data Processing Software	Location	Purchase
GCMS-C	Hewlett-Packard 5890 / 5970 MSD / HP OI 4552 / 4560	2643A122671 / 2807A1146	HP Chemstation	HP Enviroquant	Organics; Volatiles	1990
GCMS-D	Hewlett-Packard 6890 / 5973 MSD / OI 4551 / 4560 P&T	US00030551 / US93122843	HP Chemstation	HP Enviroquant	Organics; Volatiles	2001
GCMS-E	Hewlett-Packard 6890 / 5973 MSD / OI 4551 / 4560 P&T	US00031161 / US93112044	HP Chemstation	HP Enviroquant	Organics; Volatiles	2001
GCMS-F	Hewlett-Packard 6890 / 5973 MSD / HP 7683 AS	US00034179 / US84202752 / US01140200	HP Chemstation	HP Enviroquant	Organics; SVOCs	1998
GCMS-G	Hewlett-Packard 5890II / 5970 MSD / OI 4552 / 4660	2919A22540 / 2807A11004	HP Chemstation	HP Enviroquant	Organics; Volatiles	1989
GCMS-H	Hewlett-Packard 5890II+ / 5972 MSD / HP 7673 AS	3336A58190 / 3501A02356	HP Chemstation	HP Enviroquant	Organics; SVOCs	1995
GCMS-I	Hewlett-Packard 5890 / 5970 MSD / OI 4551 / 4560	2623A08318 / 2637A01687	HP Chemstation	HP Enviroquant	Organics; Volatiles	1986
GCMS-J	Hewlett-Packard 5890 / 5970 MSD / OI 4552 / 4560 P&T	2643A11557 / 3034A12779	HP Chemstation	HP Enviroquant	Organics; Volatiles	1990
GCMS-K	Hewlett-Packard 5890II / 5970 MSD / OI 4551 / 4560 P&T	2750A116838 / 2905A11628	HP Chemstation	HP Enviroquant	Organics; Volatiles	1990
GCMS-L	Hewlett-Packard 5890 / 5970 MSD / OI 4551 / 4560 P&T	2921A22898 / 2623A01291	HP Chemstation	HP Enviroquant	Organics; Volatiles	1992
GCMS-M	Hewlett-Packard 6890 / 5973 MSD / HP 7683 AS	US00021813 / US802111003 / US81501001	HP Chemstation	HP Enviroquant	Organics; SVOCs	1999
GCMS-N	Hewlett-Packard 5890 / 5970 MSD / Tekmar 2000 / 2032 P&T	2750A17088 / 2716A10218	HP Chemstation	HP Enviroquant	Organics; Volatiles	1988
GCMS-P	Agilent Technologies 5973 / 6890N AS 4552 / 4560	US10251064 / US21844596 / CN24828486	HP Chemstation	HP Enviroquant	Organics; SVOCs	2003
GCMS-Q	Hewlett-Packard 5890II / 5971 MSD / Entech Air Samp 7000	3033A31092 / 3188A02934	HP Chemstation	HP Enviroquant	Air Laboratory	1993
GCMS-R	Hewlett-Packard 6890 / 5973 MSD / HP 7683 AS	US00021820 / US81211033 / CN40334835	HP Chemstation	HP Enviroquant	Organics; SVOCs	1998
GCMS-S	Hewlett-Packard 6890 / 5973 MSD / OI 4552 / 4660 ARCHON	US00024322 / US82311313	HP Chemstation	HP Enviroquant	Organics; Volatiles	2000
GCMS-T	Hewlett-Packard 6890 / 5973 MSD / OI 4551A / 4660 P&T	US00024323 / US82311482	HP Chemstation	HP Enviroquant	Organics; Volatiles	2000

Equipment	Manufacture & Description	Serial Number	Operating System Software	Data Processing Software	Location	Purchase
GCMS-U	Hewlett-Packard 6890 / 5973 MSD / HP 4551A / 4660	US00032623 / US94212203	HP Chemstation	HP Enviroquant	Organics; Volatiles	1999
GCMS-V	Agilent Technologies 5973 / 6890N AS 4552 / 4560	US10149085 / US10441917	HP Chemstation	HP Enviroquant	Organics; Volatiles	2002
GCMS-W	Agilent Technologies 5973 / 6890N AS Entech 7016CA	US44621451 / CN10517032 / 1119	HP Chemstation	HP Enviroquant	Air Laboratory	2005
GCMS-X	Agilent Technologies 5973 / 6890N AS 4552 / 4660	US21843889 / US10239071	HP Chemstation	HP Enviroquant	Organics; Volatiles	2002
GCMS-Y	Agilent Technologies 5973 / 6890N AS 4552 / 4560	US10240013 / US21844012	HP Chemstation	HP Enviroquant	Organics; Volatiles	2002
GCMS-Z	Agilent Technologies 5973 / 6890N AS 4552 / 4560	US10251028 / US21844586 / CN24828485	HP Chemstation	HP Enviroquant	Organics; SVOCs	2003
GPC4	Waters 717	717-000152	None	None	Organic Prep	1992
Hg Analyzer	Leeman Mercury Analyzer HYDRAA	HA-3011	WIN Hg Runner	WIN Hg Runner	Inorganics	2003
Hg Analyzer	Leeman Mercury Analyzer PS200II	Hg6037	WIN Hg Runner	WIN Hg Runner	Inorganics	1999
Hg Analyzer	Leeman Mercury Analyzer HYDRAAF Gold+	9003	WIN Hg Runner	WIN Hg Runner	Inorganics	2010
HPLC-1	Agilent Technologies 1100 Series G1321A / G1315B / G1316A / G1379A	DE33205279; DE33219455 ; DE33234553; JP13210348	HP Chemstation	HP Enviroquant	Organics; SVOCs	2003
IC	Dionex DX500	99040750	Dionex Peak Net Run	Dionex Peak Net Run	Inorganics	1999
IC	Dionex ICS2000	02090737	Dionex Chrom. Client	Dionex Chrom. Client	Inorganics	2004
IC	Dionex ICS2000	02110028	Dionex Chrom. Client	Dionex Chrom. Client	Inorganics	2004
IC	Dionex ICS2000	04060060	Dionex Chrom. Client	Dionex Chrom. Client	Inorganics	2004
IC	Dionex ICS3000	06040160	Dionex Chrom. Client	Dionex Chrom. Client	Inorganics	2006
IC	Metrohm-Peak IC	1844012003147	MagIC Net	MagIC Net	Inorganics	2007

Equipment	Manufacture & Description	Serial Number	Operating System Software	Data Processing Software	Location	Purchase
ICP	Thermo Trace 61E Purge	10970	Thermo ICP Manager	Thermo ICP Manager	Metals Analysis	2000
ICP	Thermo ICP 6500 Duo	ICP-20072601	ITEVA	ITEVA	Metals Analysis	2007
ICP	Thermo ICP 6500 Duo	ICP-20074909	ITEVA	ITEVA	Metals Analysis	2007
ICP-MS	Thermo Elemental X-Series ICP-MS	X0180	Thermo PlasmaLab	Thermo PlasmaLab	Metals Analysis	2003
ICP-MS	Agilent 7700 Series	JP10340551	MassHunter Workstation	MassHunter Workstation	Metals Analysis	2010
IR Spec.	Buck Scientific HC-404	687	None	None	Inorganics	1997
PH Meter-4	Orion 710A	3978	None	None	Inorganics	1996
PH Meter-9	Orion 250A	O18019	None	None	Field Serv.	2007
PH Meter-10	YSI	JC02538	None	None	Field Serv.	2007
PH Meter-11	YSI	JC02540	None	None	Field Serv.	2010
PH Meter-12	Thermo Orion 310	14011	None	None	Inorganics	2003
PH Meter-13	VWR IS B20	5942	None	None	Sample Managament	2010
PH-EH Meter-22	Thermo Orion 4 Star	SN00742	None	None	Inorganics	2008
PH Meter-23	Thermo Orion Model 310	SN013786	None	None	Inorganics	2008
PH Meter-26	Thomas Scientific TS 625	06390411	None	None	Inorganics	2007
PH Meter-46	Thermo Orion 4 Star	B10299	None	None	Inorganics	2008
PH Meter-47	Thermo Orion 4 Star	B04869	None	None	Inorganics	2008

Equipment	Manufacture & Description	Serial Number	Operating System Software	Data Processing Software	Location	Purchase
PH Meter-48	Thermo-Orion 4 Star	B05968	None	None	Inorganics	2008
PH Meter-49	Orion Star Series	B27588	None	None	Inorganics	2010
PH Meter-50	Orion Star Series	B27564	None	None	Inorganics	2010
SCON Meter	YSI-30	J0183	None	None	Field Serv.	2004
SCON Meter	Amber Science 1056	01020851056-101	None	None	Inorganics	2001
SCON Meter	Orion 145+	78035	None	None	Inorganics	2004
SCON Meter	Oakton 4003	78643	None	None	Inorganics	2004
Solvent Extractor	Horizon SPE-DEX 3000XL	09-1031	None	None	Inorganics	2010
Solvent Evaporator	Horizon SPEED VAP III	09-0739	None	None	Inorganics	2010
Sonicator	Sonics Vibracell VC 750	31800A	None	None	Organic Prep	2000
Sonicator	TEKMAR Sonicator	6916	None	None	Organic Prep	1997
TOC Analyzer	Shimadzu 5000 Series A/S system	30825274	Shimadzu TOC Control	Shimadzu TOC Control	Inorganics	2000
TOC Analyzer	Shimadzu 5000 Series A/S system	35517409	Shimadzu TOC Control	Shimadzu TOC Control	Inorganics	1998
TOC Analyzer	Shimadzu TOC-V CSH	H51104435198 CS	Shimadzu TOC Control	Shimadzu TOC Control	Inorganics	2007
TOX Analyzer	Mitsubishi TOX-10E	75R04185	None	None	Inorganics	1996
TOX Analyzer	Mitsubishi TOX-100	A7M 42997	None	None	Inorganics	2008
Turbidimeter	HF Scientific DRT 100B	21141	None	None	Inorganics	1987

Equipment	Manufacture & Description	Serial Number	Operating System Software	Data Processing Software	Location	Purchase
UVVIS Spec C	Spectronix 20 Genesys	3SGA122034	None	None	Inorganics	2000
UVVIS Spec D	Spectronix 20 Genesys	3SGF170020	None	None	Inorganics	2007
UVVIS Spec E	Spectronix 20 Genesys	3SGD.352011	None	None	Inorganics	2007
UVVIS Spec F	Spectronix 20 Genesys	356329906	None	None	Inorganics	2007
UVVIS Spec G	Thermo Electron Corp. Genesys 20	3SGJ238001	None	None	Inorganics	2007
UVVIS Spec H	Thermo Electron Corp. Genesys 20	3SGJ306016	None	None	Inorganics	2007
UVVIS Spec I	Thermo Electron Corp. Genesys 10VIS	2D5L110005	None	None	Inorganics	2009

Quality Systems Manual

Alpha Analytical, Inc.

D/B/A

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Laboratory Director / Tech Director Westboro: Christopher Wakefield, Ext. 508-439-5124
Laboratory Director / Tech Director Mansfield: Joseph Watkins 508-844-4125
Technical Director / Air /Mansfield: Andy Rezendes 508-844-4181

1 Mission Statement

The mission of Alpha Analytical is quite simply to provide our clients with the greatest value in analytical service available. For the 'greatest value' is not only found in the data that is delivered, it is also found in the services provided.

- Data must be of the highest integrity, accuracy and precision.
- Consultation and educational services must be provided to support the customer in establishing data quality objectives and interpretation of the final data package.
- Support services such as sample containers, courier service and electronic data deliverables must be available to the client.

Alpha's mission continues with an established commitment to our community and environment. We must ensure that we do not produce any additional contamination to our environment or harm our neighbors and community in any way.

The value of Alpha's product is in the honesty and integrity with which each chemist, courier, login staff member, or office staff member performs their tasks. The client or employee must always feel satisfied that they received the greatest value in their lab experience at Alpha.

Alpha Analytical Labs will vigorously pursue its mission into the next millennium.

Mark Woelfel

President

1.1 Signature Page

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~~Controlled Document~~ AR

1.2 Management Authorization

Uncontrolled Document

President

Signature: _____ Date: 2/1/11

Name: Mark Woelfel

Quality Assurance Officer

Signature: _____ Date: 1-13-2011

Name: James Todaro

Laboratory Director / Technical Director (Westboro)

Signature: _____ Date: 1/13/11

Name: Christopher Wakefield

Laboratory Director / Technical Director (Mansfield)

Signature: _____ Date: 1/20/11

Name: Joseph Watkins

Technical Director / Air (Mansfield)

Signature: _____ Date: 1/24/11

Name: Andy Rezendes

The above signed understand and acknowledge that Alpha Analytical is required to be continually in compliance with the National Environmental Laboratory Accreditation Conference (NELAC) standards

ISSUE AMENDMENTS

Edited name of Lab/Technical Director – Mansfield

Section 14.1: Samples needing special reports when subcontracting (i.e. MCL)

Section 13, Item 18: Reports indentify analytes certified and non certified and certification identifications.

Section 13, Item 19: Reports indicating inclusion of MCLs

Section 17, 18: Updated Organizational Charts and List of Personnel

Appendix J: Added Standard Operating Procedures

2 Table of Contents

3 Introduction

The Quality Systems Manual (QSM) of Alpha Analytical describes the quality program in use at the laboratory for both Westboro and Mansfield facilities. This Quality Systems Manual provides employees, clients and accrediting agencies with the necessary information to become familiar with how the quality system operates within Alpha Analytical. The quality program includes quality assurance, quality control, and the laboratory systems including feedback mechanisms for the automated continuous improvement of the laboratory operations to meet client needs.

Implementation of the laboratory operations is by documenting procedures, training personnel and reviewing operations for improvement. Written procedures are maintained as Standard Operating Procedures (SOPs). The SOPs are available to the staff as an uncontrolled, electronic, secure copy. The provisions of the QSM are binding on all temporary and permanent personnel assigned responsibilities. All laboratory personnel must adhere strictly to the QSM and SOPs.

All policies and procedures have been structured in accordance with the National Environmental Laboratory Accreditation Conference (NELAC) standards, applicable EPA requirements, applicable Department of Defense (DOD) Quality Systems Manual, Rev 4.1 standards and for the Mansfield facility, the Louisiana Administrative Code & Regulatory Requirements according to Title 33, Part 1, Office of the Secretary, Subpart 3, Laboratory Accrediation.

Fifteen (15) sections comprise the QSM. Related quality documentation including the listing of SOPs, forms, floor plan, equipment, personnel and laboratory qualifications are available. The QSM sections provide overview descriptions of objectives, policies, services and operations.

3.1 Scope

The QSM describes the requirements of the Laboratory to demonstrate competency in the operations for performing environmental tests for inorganic, organic, air and microbiological testing. The basis for the environmental tests is the methods found in documents published by the United States Environmental Protection Agency (EPA), ASTM, AOAC, APHA/AWWA/WEF, Standard Methods, DOD-QSM 4.1, and other procedures and techniques supplied by clients.

The QSM includes requirements and information for assessing competence and determining compliance by the laboratory to the quality system. When more stringent standards or requirements are included in a mandated test method, by regulation, or specified in a project plan the laboratory demonstrates achievement of the client specified requirements through its documented processes.

The QSM is for use by Alpha Analytical for developing and implementing the quality system. Accrediting authorities and clients use the QSM for assessing the competence of Alpha Analytical. Alpha Analytical is committed to continually improving the quality system. Meeting customer needs, operating within regulatory requirements and adhering to Alpha's Data Integrity and Ethics policy are several of the mechanism used to continually improve the quality system.

3.2 Policy Statement

This Quality Systems Manual summarizes the policies, responsibilities and operational procedures associated with Alpha Analytical. This manual applies to all associates of the laboratory and is intended for use in the on-going operations at Alpha Analytical. Specific protocols for sample handling and storage, chain-of-custody, laboratory analyses, data reduction, corrective action, and reporting are described. All policies and procedures have been structured in accordance with the National Environmental Laboratory Accreditation Conference (NELAC)

standards, applicable EPA requirements, regulations, guidance, and technical standards and DOD QSM 4.1 standards. This Quality Systems Manual, laboratory Standard Operating Procedures (SOPs), and related documentation describe the quality systems, policies and procedures for Alpha Analytical.

Alpha Analytical performs chemical analyses for inorganic and organic constituents in water, seawater, soil, sediment, oil, tissue and air matrices. Alpha Analytical's goal is to produce data that is scientifically valid, technically defensible, and of known and documented quality in accordance with standards developed by NELAC and any applicable state or EPA regulations or requirements. It is the commitment of the President, Operation Director, Laboratory/Technical Director and Quality Assurance Officer to work towards continuous improvement of the operation, and towards meeting our client's needs, requirements, and intended data usage. This continued commitment is built into every activity of the laboratory. It is the responsibility of Senior Management and the Department Managers to ensure that all associates familiarize themselves with, and comply at all times with, the quality systems, procedures and policies set forth in this manual, laboratory SOPs, and related documentation.

Alpha Analytical analyzes Proficiency Test (PT) samples, in accordance with NELAC and other regulatory programs, from a National Institute of Standards and Technology (NIST)-approved PT provider for the analytes established by EPA for water samples; and for other analytes and matrices. The specific analytes and matrices analyzed are based on the current scope of the laboratory services as documented in the laboratory SOPs and state certifications.

The technical and service requirements of all requests to provide analyses are thoroughly evaluated before commitments are made to accept the work. This includes a review of facilities and instrumentation, staffing, and any special QC or reporting requirements to ensure that analyses can be performed correctly and within the expected schedule. All measurements are made using published reference methods or methods developed by Alpha Analytical. Competence with all methods is demonstrated according to the procedure described in SOP/ 08-12 prior to use.

Alpha Analytical has developed a proactive program for prevention and detection of improper, unethical or illegal actions. Components of this program include: internal proficiency testing (single and/or double blind); electronic data audits and post-analysis data review by the QA Officer; a program to improve employee vigilance and co-monitoring; and Ethics Training program identifying appropriate and inappropriate laboratory practices, instrument manipulation practices and consequences. Additionally, all associates are required to sign the Alpha Analytical *Ethics Agreement* form upon commencement of employment and each year following. This form clearly outlines the possible consequences of unethical or improper behavior, or data misrepresentation.

It is the policy of the laboratory to discourage and reject all influence or inducements (whether commercial, financial or personal) offered either by customers or suppliers, which might adversely affect results or otherwise compromise the judgment or impartiality of the staff. It is the responsibility of the Operations Director and Laboratory/Technical Director to inform customers and suppliers of this policy when necessary.

In the event that any such influences or inducements are encountered, the staff is instructed to inform management immediately. It is the responsibility of the Operations Director and the Laboratory/Technical Director to take appropriate action to prevent recurrence.

3.3 References

An electronic register of external documents or books is available on the company intranet for staff to determine the latest edition or version of the reference methods, regulations or national standards. The Quality Assurance Department maintains the register. Management purchases automated update services, where available, to provide the laboratory with the latest hardcopy edition, where electronic means is not available.

3.4 Definitions

Appendix A lists the definitions as adopted by the laboratory. The definitions are from the standard approved in June, 2005, by the National Environmental Laboratory Accreditation Conference (NELAC). The definitions in Appendix A are updated, as necessary, after publication of the NELAC adopted Glossary.

4 Organization and Management

4.1 Legal Definition of Laboratory

Alpha Analytical is a full service analytical laboratory. Testing services include Drinking Water, Waste Water, Ground Water, Waste material and Air. Alpha Analytical is a privately held corporation incorporated in the state of Massachusetts. Alpha Analytical, Inc. does business as (D/B/A) Alpha Analytical.

Alpha Analytical has been in business since 1985. The types of businesses served include:

Consulting firms,
Engineering firms,
Waste Management Companies,
Industrial sites,
Municipal agencies and
Other commercial businesses.

4.2 Organization

The laboratory operates a quality system approach to management in order to produce data of known quality. The laboratory organization provides effective communication and lines of authority to produce analytical data meeting client specifications. The organizational design provides open communication while ensuring that pressures and day to day operating circumstances do not compromise the integrity of the reporting of the final data.

The President is responsible for directing all areas of the company. The following job functions report to the President:

Operations Managers
Quality Assurance Officer
Client Services Manager
Marketing / Business Development / Sales
Financial Services
Human Resources

The Operations Manager is responsible for directing all laboratory operational areas of the company. The following job functions report to the Operations Manager:

- Laboratory/ Technical Director(s)
- Department Managers

The Laboratory/Technical Director(s) is responsible for the laboratory data generated by the organics testing, inorganics testing and metals testing areas and the Air Technical Director is responsible for laboratory data generated by air analyses.

The Departmental Managers (Supervisors) have the following responsibilities:

The organics managers direct personnel in the organics extraction and instrumental laboratories.

The wet chemistry manager directs personnel and team leaders in the wet chemistry and/or microbiological testing areas.

The metals manager directs personnel and team leaders in the metals sample preparation and instrumental laboratories.

The Quality Assurance Officer is a member of the staff reports directly to the President and has defined responsibility and authority for ensuring that the quality system is implemented and adhered to at all times. The Quality Assurance (QA) Officer is responsible for interacting and communicating certification requirements, implementing the Quality Systems Manual and reporting to the Laboratory Director and Senior Management the status of the quality program. The QAO oversees the Quality Systems Specialists and is responsible for oversight and/or review of quality control data and function independently from laboratory operations.

The Client Services Manager is responsible for client interactions, project coordination and laboratory personnel notification of project requirements. Also the Client Services Manager is responsible for the areas of sample container preparation and transportation of containers and samples to and from the laboratory.

The Marketing, Business Development and Sales personnel are responsible for increasing the volume of work from current clients and adding new clients to the base business of Alpha Analytical. The Marketing and Business Development personnel review all new work with the Laboratory Director, Operations Manager, President and/or Quality Assurance Officer before contractual commitment.

The Controller is responsible for maintaining and reporting on the financial status of the company. The Controller directs financial personnel on proper accounting procedures and maintaining the list of approved suppliers and subcontractors. The Controller reports directly to the President.

The Human Resource Director is responsible for personnel recruitment, hiring, performance reviews.

Personnel job descriptions define the operational function duties and responsibilities. Administration and Laboratory personnel assignments may include cross-functional training and work performance in multiple areas of the operations. Multiple function training ensures laboratory back up personnel during peak work loads.

During the absence of any staff member, assignment of alternative personnel occurs by memo or e-mail. The Manager or Supervisor authorizes the assignment. The naming of alternative personnel assures the continuing performance of critical tasks during the primary person's absence and ensures that lines of communication remain open for continued decision making. The deputy for the Laboratory Director is the Quality Assurance (QA) Officer. The deputies for the Quality Assurance (QA) Officer are the Quality Systems Specialists.

For the purposes of NELAC Accreditation and DOD QSM 4.1, the Lead Laboratory Technical Director is the Laboratory Director. The deputies for the Lead Technical Director are the Quality Assurance (QA) Officer, and the Departmental Managers. The Laboratory/Technical Director meets the requirements specified in the Section 4.1.1.1 of the NELAC standards. If the Technical Director is absent for a period of time exceeding 15 consecutive calendar days, a full-time staff member meeting the qualifications of Technical Director will be designated to temporarily perform this function. The primary Accrediting Body shall be notified in writing if the Technical Director's absence exceeds 65 consecutive calendar days.

4.3 Business Practices

Alpha maintains certification for the programs and analytes required by regulatory programs. The listing of qualifications from the various certifications, registrations and accreditation programs are available upon request. Alpha Analytical operates Monday to Friday from 7:30 a.m. to 5:30 p.m. Management prepares and posts the holiday schedule for the year indicating closed operations. Sample delivery occurs during normal operating hours unless arranged in advance.

Alpha's reputation depends upon timely reporting and quality data. The standard turnaround time for engineering and consulting firms is five business days from time of sample receipt. Standard turnaround for all other clients is ten business days from time of sample receipt. The time of sample receipt is when the verification of the chain of custody and samples meets the laboratory sample acceptance policy. Laboratory management must approve any special arrangements for rush or expedited turnaround time. The basis for data quality depends on client, regulation and method performance criteria. Accuracy, precision, sensitivity and comparability are expressions of method performance criteria.

All work is performed in the strictest confidence. New and contract employees must review corporate policy and practice requirements for protecting client confidentiality and proprietary rights. The review occurs during orientation and ethics training. It is the policy of the laboratory to release data to the client authorized contact. Personnel assigned the duties of interacting with clients review project files and discuss data related only to the project. Personnel whose duties do not include routine client contact must check with the client service manager before discussing data with regulators or third parties.

5 Quality System

Establishment, Audits, Essential Quality Controls and Data Verification

5.1 Establishment

The Mission Statement presents the policy and objectives for Alpha Analytical. The Quality Systems Manual provides the framework for the processes and operations to implement the Mission. The Quality Systems Manual and documentation controlled by the laboratory system detail the management authorized operations for achieving the objectives of the company.

The laboratory operates a quality system approach to management in order to produce data of known quality. Alpha Analytical is a full service laboratory designed to provide its clients with accurate, precise and reliable data within the best turn-around time and at the most reasonable prices. Alpha employs chemists of the highest training, ethics and caliber in the field of analytical chemistry. This and state-of-the-art instrumentation and automation combine to insure data of known and documented quality.

5.2 Quality Systems Manual

The QA Officer is responsible for the publication and distribution of the Quality Systems Manual. Management reviews and authorizes the manual. Implementation of major changes in the quality system occurs after revision of the appropriate Quality Systems Manual section and authorization by management.

The authorization signatures found on the signature page of the manual signify management review and approval of the Quality Systems Manual. The Signature section must be kept current and reflect any organizational changes affecting the authorizing positions. Updates of this manual occur at any time throughout the year. The issue number and date are changed to denote the latest revision date. The revision date for the signature section must be the most recent, indicating that all revisions have undergone management review.

Document control procedures (SOP/08-01) apply to the distribution of the Quality Systems Manual. Distribution of controlled copies of the manual is only to an individual within the laboratory. Persons or organizations outside of Alpha Analytical may receive uncontrolled copies. Copies are distinctly marked "Uncontrolled Documents". A distribution list is maintained for all controlled copies of the Quality Systems Manual. All parties listed on the controlled distribution list receive document updates. Copies marked as uncontrolled copies are not subject to updates.

5.3 Audits

Laboratory audits, both internal and external, review and examine the operations performed in the laboratory. Internal audits are condcted by qualified QA Specialist and external audits are reviews by external organizations to evaluate the ability of the laboratory to meet regulatory or project requirements.

A QA designee schedules internal process audits to ensure the completion of the annual audit of each operational area. The process audits are a more detailed review of the operations. Personnel from areas other than the one audited perform process audits.

The internal system audit is a review of the implementation of the documented quality system. The system audit includes sample tracking from receipt to disposal, a data audit of a completed report, and all operations not audited during the process audit.

The purpose of the internal system audit is:

Verification that adequate written instructions are available for use;

Analytical practices performed in the laboratory are consistent with SOPs;

The quality control practices are applied during production;

Corrective actions are applied as necessary;

Deviations from approved protocols are occurring only with proper authorization and documentation;

Reported data is correct and acceptable for reporting;

SOPs, quality records, analytical records, electronic data files are maintained properly; and

Personnel training files and records are satisfactory and current.

Before a scheduled audit, the assigned auditor reviews checklists and/or the SOP specific to the area. The checklist may be from an external source or prepared by the auditor. The checklist must include all references to the documented quality system or referenced requirements document. After the audit, the auditor submits a summary or notes from the audit to the Laboratory Director or QAO as part of the audit report. The summary identifies discrepancies found during the audit. A copy of the summary form is presented to the person responsible for implementation or resolving the problem. The checklist, notes and summary comprise the audit report.

Technical personnel are responsible for the inspection and monitoring of in-process and final data. Personnel independent of those having direct responsibility for the work performed audit the quality system and processes.

Representatives sent by clients and government or accrediting agencies often perform external audits. These audits are most often announced inspections, but sometimes are not announced. The Quality Assurance Officer, Laboratory Director or assigned deputy, or appropriate Department Manager accompanies the external audit team through the laboratory. The auditors receive a brief overview of company objectives, activities, and facilities. Interviews with essential supervisory staff and technical staff are arranged, along with retrieval of any documentation pertinent to the audit. Auditors usually provide a report on their findings shortly after the audit. The QA Officer receives the audit report and copies are provided to laboratory personnel for review. Corrective actions are identified and distributed to responsible parties for implementation in response to any cited deficiencies.

5.4 Audit Review

Management reviews internal and external audit reports to evaluate system effectiveness at the annual management review meeting. Tracking of the audit findings occurs through the nonconformance action process. The management and staff work together to establish a time line for resolving the audit findings. The Quality Assurance team tracks the time line and reports to the Laboratory Director on any outstanding audit findings.

5.5 Performance Audits

Alpha Analytical participates in inter-laboratory comparisons and proficiency test programs required by clients and certifying agencies. The performance audits provide information on the data comparability of results generated by the laboratory. Test samples received by the laboratory are handled following routine laboratory procedures. Proficiency test samples are

unpacked, checked against the packing slip and examined for damage. Reporting requirements and deviations to routine practices are noted as would be required for any project.

Analysts demonstrate proficiency by analyzing either an external proficiency test sample, an internally prepared blind test sample or Initial Demonstration of Capability (IDC) before independent operation of a test method and at least once per year per analyst. The results of performance audits serve several purposes. The QA Officer may use performance audits for evaluating analyst proficiency, laboratory performance in a specified area to facilitate laboratory improvement efforts, and/or to provide information to an accrediting agency on correction of past performance of an external performance audit.

5.6 Corrective Actions/Preventative Actions (CAPA)

The corrective action process at Alpha Analytical is detailed in SOP/08-09. The corrective action program at Alpha Analytical uses the Nonconformance Report form to document and follow through the corrective action/preventative action process for three main areas: nonconformance's within the laboratory, client complaints and failed PT studies. The mechanism for recording, reviewing and acting upon all quality problems is self-explanatory as the form is completed. The process ensures continuous improvement of company performance by preventing the recurrence of quality problems.

Nonconformance forms are tracked for closure date and the type. Reports to management include the listing of open nonconformance reports and the frequency of the type of nonconformance occurring. A QA designee records the forms and monitors the completeness of the forms, as well as verifies the actions are complete and acceptable.

Clients will be notified within 5 days of any question(s) regarding validity of results.

For Louisiana ELAP (LELAP) certified parameters, any PT results that are "unacceptable" for a specific analyte must be investigated and likely cause(s) for the results determined. Any problems must be resolved and reported to LELAP, along with the submittal of corrective action PT sample test results.

5.7 Managerial Review

The management review occurs at least once per year as part of the strategic planning process. Documentation of the management review meeting is by recording the meeting minutes and listing the attendees. The focus of the quality management review is the frequency of the type of nonconformance, closure status, audit progress and other quality assurance actions. Meetings include discussion and progress on quality system initiatives since the last meeting.

Prior to the meeting, an agenda is distributed to all personnel expected to be in attendance. The meeting is chaired by the Quality Assurance Officer. Minutes are taken and distributed at the conclusion of the meeting by a QA designee. If action is necessary on any issue, a Summary Report is generated and distributed to responsible parties for implementation. Actions are monitored by the QAO or designee until completion.

5.8 Essential Quality Control Procedures

The following general quality control principles apply to all tests. The manner implemented is dependent on the type of test performed. The laboratory SOP presents the specific quality control checks undertaken to ensure precision, accuracy and sensitivity of each test method.

Alpha Analytical uses quality control samples to evaluate the following:

1. Adequate positive and negative controls to monitor blanks, spikes, reference toxicants, zero blanks;
2. Adequate tests to define the variability and/or reproducibility of laboratory results;
3. Measures to ensure the accuracy of the test data including sufficient calibration and/or continuing calibrations, use of certified reference materials, proficiency test samples;
4. Measures to evaluate test performance, such as method detection limits and quantitation limits or range of applicability such as linearity;
5. Selection of appropriate formulae to reduce raw data to final results such as linear regression, internal standards, or statistical packages;
6. Selection and use of reagents and standards of appropriate quality;
7. Measures to assure the selectivity of the test for its intended purpose;
8. Measures to assure constant and consistent test conditions for the method such as temperature, humidity, light, or specific instrument conditions.

All quality control measures are assessed and evaluated on an on-going basis, and quality control acceptance limits are used to determine the usability of the data. Control charts and/or calculated control limits monitor the long-term method performance by analyte, by instrument for water matrices. Routine evaluation and reporting of the control chart performance provides supervisors and management with additional performance measures to ensure data comparability. Control limits are recalculated when trends are observed.

Where no reference method or regulatory criteria exist, the laboratory specifies the acceptance/rejection criteria in the SOP. The test SOP specifies the QC samples performed per batch of samples. The quality control samples are categorized into the following, as appropriate to the method

Method Blank
Laboratory Duplicate
Laboratory Control Sample (LCS)
Laboratory Control Sample Duplicate (LCSD)
Matrix Spike (MS)
Matrix Spike Duplicate (MSD)

The frequency is dependent on the reference method and test protocol. The following is the default requirement for quality control checks in lieu of any other guidance. The frequency for each quality control sample is generally one (1) per every 20 samples.

5.9 Data Reduction

After completion of the test procedure, the data reduction process begins.

Chromatography data may require the manual integration of peak areas or heights before reporting of results. The analyst must perform manual integration when software does not properly integrate or identify the peak. Manual integration must not occur for the purpose of achieving acceptable quality control or calibration. The analyst and reviewer sign and date the hardcopy of all manual integration. The analyst notes the rationale for performing the manual integration on the hardcopy printout and ensures the "TIC" marks from the software represent the integration area used for reporting the results. The analyst must minimize and avoid manual integration. The establishment of the proper integration parameters in the software reduces the number of manual integration occurrences.

The SOP for each test presents the formulas used for the specific test method. The formulas for the data calculations used throughout the laboratory are the following:

% Recovery (LCS)

$$\frac{MV}{TV} * 100 = \%R_{LCS}$$

where: *MV* = Measured Value
TV = True Value

% Recovery (MS or MSD)

$$\frac{MV - SV}{TV} * 100 = \%R_{MS}$$

where: *MV* = Measured Value
TV = True Value
SV = Amount found in sample

Average ($\overline{X}$)

$$\sum_{i-1}^{n} X_i \Big/ n = \overline{X}$$

where: $\overline{X}$ = Average of all values
X = Result of each measurement
n = Number of values

Relative Percent Difference (% RPD)

$$\frac{R_1 - R_2}{(R_1 + R_2)/2} * 100 = \%RPD$$

where: R_1 = Larger of two observed values
R_2 = Smaller of two observed values

% Difference (%D)

$$\frac{X - \overline{X}}{\overline{X}} * 100 = \%D$$

where: $\overline{X}$ = Average of all values
X = Result of measurement

Standard Deviation of the sample (S_x)

$$\sqrt{\frac{\sum\left(X - \overline{X}\right)^2}{n-1}} = S_x$$

where: $\overline{X}$ = Average of all values
X = Result of each measurement
n = Number of values

Relative Standard Deviation (%RSD)

$$\frac{S_x}{\overline{X}} * 100 = \%RSD$$

where: $\overline{X}$ = Average of all values
Sx = Standard Deviation (n - 1)

Range of Logs (for microbiological enumeration analysis)

10% of routine samples are analyzed in duplicate and the range of logs is determined.

MDL (See 40CFR Part 136 for details)

$$\left[\sqrt{\frac{\sum_{i=1}^{n} x_i^2 - \left(\sum_{i=1}^{n} x_i\right)^2 / n}{n-1}}\right] * t_{0.99} = MDL$$

where: *MDL* = The method detection limit
X = Result of each measurement
n = Number of values
t(n-1,1 = .99) = The students' t value appropriate for a 99% confidence level and a standard deviation estimate with n-1 degrees of freedom. (See Students t Test Table)

Reporting Limit (RL)

Lowest calibration standard or greater
At least 3 times the calculated MDL

Reportable Detection Limit (RDL)

Lowest calibration standard or greater adjusted for sample/matrix

Control Limits

Upper Control Limit: $\overline{X} + 3 * S_x = UCL$
Lower Control Limit: $\overline{X} - 3 * S_x = LCL$

Warning Limits

Upper Warning Limit: $\overline{X} + 2 * S_x = UWL$
Lower Warning Limit: $\overline{X} - 2 * S_x = UWL$

Method of Standard Additions (MSA): (See EPA 7000A for details)

The simplest version of this technique is the single-addition method, in which two identical aliquots of the sample solution, each of volume Vx, are taken. To the first (labeled A) is added a known volume Vs of a standard analyte solution of concentration Cs. To the second aliquot (labeled B) is added the same volume Vs of the solvent. The analytical signals of A and B are measured and corrected for non-analyte signals. The unknown sample concentration Cx is calculated:

$$C_x = \frac{SB\ V_S\ C_s}{(SA - SB)\ V_X}$$

where SA and SB are the analytical signals (corrected for the blank) of solutions A and B, respectively. V_S and C_s should be chosen so that SA is roughly twice SB on the average, avoiding excess dilution of the sample. If a separation or concentration step is used, the additions are best made first and carried through the entire procedure.

Improved results can be obtained by employing a series of standard additions. To equal volumes of the sample are added a series of standard solutions containing different known quantities of the analyte, and all solutions are diluted to the same final volume.

For example, addition 1 should be prepared so that the resulting concentration is approximately 50 percent of the expected absorbance from the endogenous analyte in the sample. Additions 2 and 3 should be prepared so that the concentrations are approximately 100 and 150 percent of the expected endogenous sample absorbance.

The absorbance of each solution is determined and then plotted on the vertical axis of a graph, with the concentrations of the known standards plotted on the horizontal axis. When the resulting line is extrapolated to zero absorbance, the point of interception of the abscissa is the endogenous concentration of the analyte in the sample. The abscissa on the left of the ordinate is scaled the same as on the right side, but in the opposite direction from the ordinate. A linear regression program may be used to obtain the intercept concentration.

5.10 Document Control

The Document Control Procedures (Westboro SOP/08-01 and Mansfield SOP/G016) describe the process for controlled and uncontrolled documents. The use of the issue number allows for the retention of a previous document for historical information purposes.

Every document is assigned a unique identification number, which is present on each page of the document. A master list of documents includes the unique identification. Each controlled copy includes the issue number, issue date, effective date and page number.

Full document control includes the status of each document: active, inactive or superceded/archived. Inactive documents are procedures not currently requested, but may be in the future. Archived documents are procedures replaced with a later revision. Authorized personnel must review and approve each document and any subsequent revisions before use in the laboratory. Personnel authorized to review and approve a document have access to all necessary information on which to base their review and approval. The amendment section of the signature page of any SOP includes a brief description of the nature of the document change.

Standard Operating Procedures (SOPs) are instructions for repetitive or standard operations performed by the laboratory. The SOP author is the person familiar with the topic. The standard format for writing SOPs is set-up as a template for administration and technical SOPs. Each SOP is peer reviewed, authorized by management, and the Laboratory Director or QAO before final

distribution and implementation. Authorized signatories for controlled documentation include one or more of the following personnel: Company President, Quality Assurance Officer, Laboratory/Technical Director, Department Manager, Department Team Leader. Personnel acknowledge approved documents as read, understood and agreed to by personnel through signed attestation forms or training records.

SOPs must receive evaluation and input by laboratory supervisors and key technical personnel. The content of each SOP must conform to applicable requirements of analytical methods and certification agencies. Within these constraints, the content of a SOP meets the needs of a particular area of the laboratory. A new or revised SOP is needed when regulatory programs update or add methods, or the scope of the existing method is extended or when activities are being performed without adequate documentation.

Updating, modifying and changing SOPs, forms and the contents of this QSM are prompt and part of the routine practices. The prompt modification of these documents ensures the documents reflect the current practices and operations of the laboratory. Implementation of modifications required before issue of an updated SOP is authorized by the Departmental Manager on the SOP Review Form. The record of the SOP change authorization by management, QA and other analysts is placed on the nonconformance form. A copy of the approved nonconformance form is retained with the SOP. During annual review of a document, (including but not limited to: SOPs, Ethics Policy, Quality Systems Manual), requested changes are reviewed and the document reissued using the information from the nonconformance forms.

The laboratory maintains control over the possession and distribution of all documents that directly affect the quality of data. This includes, but is not limited to, documents such as the Quality Systems Manual, Standard Operating Procedures, client instructions, Laboratory Work Instructions, data sheets, check lists and forms.

5.11 Detection Limits

Method Detection Limits (MDLs) are determined for all analytes as specified in the NELAC and other standards. MDLs are determined for all new instrumentation, whenever there is a change in the test method or instrumentation that affects performance or sensitivity of the analysis. From these, detection limits, practical quantitation limits (PQLs), or Reporting Limits (RLs), are established. The PQL is the minimum concentration of an analyte that can be identified and quantified within specified limits of precision and bias during routine and analytical operating conditions.

Laboratory reporting limits lie within the calibration range, at or above the PQL. For methods that require only one standard, the reporting limit is no lower than the low-level check standard, which is designed to verify the integrity of the curve at lower levels. If reporting limits are required below the lower level of the calibration curve, PQL, or low-level check standard, method modifications are required. Refer to MDL/LOD/LOQ SOP/08-05.

5.12 LOD/LOQ Studies

A. LOD (Limit of Detection) Verification

1. LOD (Limit of Detection) verification is required annually for each target analyte in which test results are to be reported below the lowest calibration standard ("J" values) for each instrument, matrix and prep procedure.
   a. Quarterly LOD Verification is required for DOD projects.

2. All sample-processing steps of the analytical method shall be included in the determination of the LOD.

3. The validity of the LOD shall be confirmed by ***qualitative*** identification of the analyte(s) in a QC sample in each quality system matrix containing the analyte at no more than 2-3X the LOD for single analyte tests and 1-4X the LOD for multiple analyte tests. This verification must be performed on every instrument that is to be used for analysis of samples and reporting of data.

4. An LOD study is not required for any component for which spiking solutions or quality control samples are not available such as temperature. Where an LOD study is not performed, the laboratory may not report a value below the limit of quantitation.

B. LOQ (Limit of Quantitation) Verification

1. LOQ (Limit of Quantitation) verification is required annually for each target analyte that is not reported below the lowest calibration standard for each matrix and prep procedure. LOQ is not required if an annual LOD verification is performed.

2. The validity of the LOQ shall be confirmed by successful analysis of a QC sample containing the analytes of concern in each quality system matrix 1-2 times the claimed LOQ. A successful analysis is one where the recovery of each analyte is within the established test method acceptance criteria for accuracy.

The LOQ study is not required for any component or property for which spiking solutions or quality control samples are not commercially available or otherwise inappropriate (e.g., pH).

The LOQ acceptance criteria is based on the established acceptance criteria for Laboratory Control Samples.

Refer to MDL/LOD/LOQ SOP/08-05.

5.13 Range of Logs – Precision of Quantitative Methods - Microbiology

A. Precision of duplicate analyses is calculated for samples examined by enumerative microbiological methods according to the following procedure:

   a. Perform duplicate analyses on first 15 positive samples.

   b. Record duplicate analyses as D1 and D2 and calculate the logarithm of each result.

   c. If either of a set of duplicate results is <1, add 1 to both values before calculating the logarithms.

   d. Calculate the range (R) for each pair of transformed duplicates as the mean of these ranges.

6 Personnel

6.1 Laboratory Management Responsibilities

Management is responsible for communicating the requirements of the quality system, client specifications and regulatory needs to all personnel. Management job descriptions detail the responsibilities of each position.

H.R. Director has job descriptions for all positions in the laboratory defining the level of qualifications, training, and experience and laboratory skills. During initial training, management provides documented operations procedures, observes personnel performance, and evaluates personnel proficiency. Management documents technical laboratory staff's proficiency initially and on a continuing basis through use of laboratory control samples and purchased proficiency evaluation standards. Management requires successful proficiency demonstration before allowing independent production testing.

Management is responsible for verification of proper sample management and all aspects of data reporting. The communication of the operating practices of the laboratory is through the document control and attestation process.

Either the Quality Assurance Officer, Operations Director and/or Technical Directors have the authority to stop work due to non-conformances and have the authority to resume work after it has been stopped.

6.2 Laboratory Staff Requirements

Recruitment is the responsibility of the Operations Manager and HR Department, with input from other personnel as required. The Training Program procedure SOP/15-01 details the process for completing requirements and training to ensure personnel have adequate skills and competence for the job function.

A job description details the necessary requirements for each job and includes position title, minimum educational requirements, skills, responsibilities and reporting relationships and any supervisory responsibility.

Initial training of new employees and contract staff includes laboratory ethics and quality policies, as well as execution of an Ethics Agreement. Any employee found to knowingly violate the Ethics Policy Agreement, report data values, that are not actual values obtained or improperly manipulated, or intentionally report dates and times of data analyses that are not the actual dates and times of analysis, will lead to disciplinary action, including termination, as outlined in Section K of the Employee Handbook. Each employee must report personally or anomously to the Laboratory Director, QA Officer and/or Ethics Team Member any accidental or suspected intentional reporting of non-authentic data by others for follow up action. The review of the laboratory ethics policy occurs annually with all personnel. The annual review includes annual renewals of the Ethics Agreement.

The Ethics program consists of the following key components:

- Ethics Policy /Agreement (Appendix F)
- Initial and annual ethics training
- Internal audits conducted annually

- Adherence to Manual Integration SOP/08-03
- Ethical or Data Integrity issues reported to Lab Managers, QAO or HR Director
- Anonymous reporting to HR Director
- "No-fault" policy encouraging reporting of incidences without fear of retribution
- Electronic tracking and audit trails through LIMs and instruments enable where available.

6.3 Training

The Quality Systems Manual and related documentation is available to all employees. Cross training, supervisory training and other related training takes place on a scheduled and as-needed basis. Training ensures the communication and understanding of all personnel in the laboratory-documented procedures and practices.

All personnel undertake orientation-training sessions upon initial employment. Orientation training includes laboratory business practices, employment specifications, Ethics Policy, Quality Systems Manual, Chemical Hygiene Plan, and all SOPs required for the job function.

Managers ensure the training for new employees and review the continuing training for current employees. Training includes on-site and off-site programs presented by staff members, contractors, equipment manufacturers, and institutions of higher learning.

Training of new personnel to any job assignment takes place on-site according to the Training Program procedure. Laboratory personnel may perform their assigned methods/protocols without supervision only after documentation of acceptable proficiency. Training records lists the current training status.

On-the-job training includes demonstration of skills during job performance, initial demonstration of proficiency, and review of SOPs. Safety and health training takes place on an annual basis with careful introduction to new principles. Personnel have access to the Chemical Hygiene Plan and Material Safety Data Sheets. On-site training includes side-by-side hands-on training, formal classroom type instruction on the SOP or a meeting to discuss procedural changes or to address questions related to the laboratory operation. All training is documented via the Training Attestation Form, which is signed by all in attendance that they understood and will implement what was presented to them.

Training is an on-going opportunity to evaluate the laboratory operations. The updating of SOPs, Quality Systems Manual and other related information documents all changes to the quality system. In all cases, training is documented via the Training Attestation Form.

Off-site training takes place on an as-needed basis. Recommendations and suggestions regarding educational programs come from all levels of staff. It is the employee's responsibility to present a copy of any certificates or attendance information to the HR Director. The information is added to the individual's training record.

6.4 Records

The QA Department is responsible for maintaining training records. Attestation forms, certificates, demonstration of capability forms and other records of training are placed in the individual's training file.

The Quality Assurance Officer or designee notifies appropriate personnel when a revision is complete for the controlled version of a document. Laboratory staff must implement the change as of the effective date. The manager of the area determines when a change is significant to require training.

Job descriptions are included in the training record files. The Human Resources Department reviews the job descriptions, resumes and training records to ensure up-to-date information on the job descriptions and resumes. The Human Resources Department and the individual update the resume on an as needed basis. Resumes and/or biosketches are kept on file with the Human Resources Department and the QA Department.

7 Physical Facilities – Accommodation and Environment

This laboratory facility has a total area of 25,000 square feet in both the Westboro and Mansfield Facilities

The laboratory functional areas include:

- Administration and offices
- Sample receiving
- Sample management
- Microbiological (Westboro Facility only)
- General analytical chemistry
- Metals sample preparation
- Organic sample preparation
- Metals analysis
- Volatiles gas chromatography (GC)
- Volatiles gas chromatography/mass spectrometry (GC/MS)
- Volatiles air analysis (Mansfield Facility only)
- Semivolatiles gas chromatography/mass spectrometry (GC/MS)
- Semivolatiles gas chromatography (GC)
- Miscellaneous facility mechanical and storage areas.

All chemicals are stored in appropriate cabinets and properly disposed of as required. All flammable solvents are stored in OSHA and NFPA approved cabinets. Acids are stored in OSHA acid cabinets. Separate waste areas houses the sample and chemical waste before pickup by a licensed waste hauler.

7.1 Environment

Lighting, noise, humidity, heating, ventilation and air conditioning satisfy the needs of the testing performed on the premises. The laboratory building design ensures regulated temperature control for analytical equipment. Air-handling systems minimize airborne contaminants that may jeopardize sample integrity or analytical performance.

The analytical instrumentation is in separate rooms from laboratory activities that involve the use of large quantities of organic solvents or inorganic acids. A separate room, in the Westboro facility, provides the facilities for the microbiological testing.

Standards and other materials requiring below 0°C storage temperatures are placed in freezers and separated from samples or potential contaminating materials. Refrigerators provide cooling needs for samples and materials with temperature requirements of below room temperature and greater than freezing. Sample and standard storage areas are monitored and controlled for temperature. Sample storage areas for volatiles are separated from other samples and monitored for any effects due to cross contamination.

Bulk hazardous waste containers are located away from the testing activities. Waste disposal uses lab pack procedures and those designated by the regulatory authorities. The Chemical Hygiene Plan and the Waste Management and Disposal SOPs (Westboro: SOP/14-01 and Mansfield SOP/G-006)) include the procedures for handling and disposing of chemicals used in the laboratory.

The working and storage environments are maintained in a safe and appropriate manner. A Chemical Hygiene Plan details the requirements for safety and chemical handling. Safety measures that protect property and personnel from injury or illness include: fume hoods, fire extinguishers, fire blankets, alarm systems, safety training, protective clothing, emergency showers, eyewashes, and spill control kits.

7.2 Work Areas

Good housekeeping is the responsibility of all personnel. Each person is responsible for assuring clean and uncluttered work areas. The job descriptions list specific housekeeping duties. Records, samples and waste materials are the common cause for clutter in the laboratory.

Management does not allow accumulation of boxed records in the laboratory operating area. Removal of administration and laboratory records to the record storage area occurs to reduce clutter and ensure traceability. The individual filling the laboratory record box, labels the box with a number, the contents, date and laboratory area. Authorized personnel assign and record into a permanent record the box number, discard date and box contents. Authorized personnel review the box label for number, discard date and contents. Boxes are stored on site and off-site for the record retention period identified in the NELAC and EPA regulations, whichever is more stringent.

Sample management personnel remove samples to the sample storage area after all data is correct and complete. Sample coolers are removed to a designated storage area for recycling. Samples are stored in the designated process storage areas until testing is complete. Sample removal from the process storage occurs after mailing of the final report. The sample management staff places the samples in the archive storage area for thirty days after report release. The archive sample storage area is not controlled or monitored. Based on client specifications, samples are properly disposed or returned to the client.

Waste materials, expired reagents, expired standards and materials are disposed of and not stored in the laboratory. Hazardous waste labeled accumulation containers in the laboratory collect designated waste streams for later bulk disposal. Laboratory personnel remove the less than five-gallon accumulation containers when full from the laboratory and place the containers in the bulk hazardous waste area. Refer to the Waste Management and Disposal SOPS for Westboro: SOP/14-01 and Mansfield SOP/G006. Personnel identifying out of date reagents and standards remove the materials to the proper disposal area.

7.3 Security

Alpha Analytical provides a secure environment for our employees, guests, clients, samples and analytical data. Security procedures require that all exterior doors remain locked unless manned. Access to the laboratory is limited to employees and contractors. Visitors not under signed contract are required to sign the Visitors Log and must be accompanied by a laboratory employee at all times within the testing areas.

The defined high security area is the sample management area. Identification card locks on the internal doors control entry into the laboratory area.

All doors are locked after hours and require a key for entry. The security alarm continuously monitors for smoke and fire related heat. When the alarm is activated, the appropriate emergency response officers are notified. The local emergency offices have the emergency contact list for the laboratory.

8 Equipment and Reference Materials

8.1 Maintenance

The laboratory has a proactive equipment maintenance program. The laboratory maintains service contracts for major equipment, which include routine preventative maintenance visits by the service provider. Technical personnel perform manufacturer's specified maintenance on a routine basis to ensure equipment operates at peak performance.

Procedures and schedules for preventive maintenance are available in the test method SOPs. A brief summary of some common preventive maintenance procedures is provided in Appendix E. All instrument preventative and corrective maintenance is recorded in the maintenance logbook assigned to the equipment. After maintenance or repair, the instrument must successfully calibrate following the method SOP. Laboratory personnel must demonstrate quality control performance before sample analysis.

The laboratory maintains a stock of spare parts and consumables for analytical equipment. Backup instrumentation for some analytical equipment is available on site for use in case of major equipment failure. The person discovering or suspecting an equipment maintenance problem or failure tags the equipment with 'out of service' tag. If routine maintenance measures do not eliminate the problem, the Laboratory Director or Operations Director is notified and the appropriate equipment service provider is contacted.

All major laboratory equipment has individual and traceable maintenance logbooks in which to document manufacturer's recommended maintenance procedures, specific cleaning procedures, comments on calibration, replacement of small worn or damaged parts, and any work by outside contractors. The person performing routine or non-routine maintenance signs and dates the maintenance logbook. If an instrument is down for maintenance, a complete record of all steps taken to put it back into service is recorded including reference to the new calibration and quality control checks. Any equipment service providers working on the equipment are recorded in the logbook.

Record repetitive or on-going equipment problems other than normal maintenance requirements on nonconformance action forms. The nonconformance action form notifies management and the Quality Assurance Officer of a problem affecting the performance and data quality.

The laboratory groups some equipment into a single laboratory equipment maintenance logbook. Examples include: autopipets, thermometer calibration. The identity of each item is by serial number or a laboratory-designated item number. The same data recorded for major equipment applies to this documentation.

The maintenance records shall include:

- Equipment name;
- Manufacturer's name, type identification, serial number or other unique identification;
- Date received, date put into service, condition when received;
- Current location;
- Details of past maintenance and future schedule;
- A history of any damage, malfunction, modification or repair;
- Dates and results of calibration or verification.

The maintenance logbook may include the reference to the location of the equipment operational and maintenance manuals. The logbook may include the reference to laboratory run logbook or data files for the calibration and quality checks of daily or frequent calibrations.

The Courier Supervisor ensures that maintenance and records for transportation vehicles are complete. The purchasing process is used for ordering garage maintenance, the garage work order is reviewed, and the vehicle checked for condition. The Controller receives all paperwork for completion of the maintenance process.

8.1.1 Microbiology General Equipment Maintenance

Optics of the Quebec colony counter and microscope are cleaned prior to each use. The stage of the microscope is also cleaned and the microscope is kept covered when not in use.

Glassware is checked for residual alkaline or acid residue utilizing bromthymol blue (BTB) on each day of media preparation.

8.2 Equipment Listing

A listing of the major equipment used for testing is available upon request. The equipment list details the unique identification number, equipment location, serial number, model number, and purchase date. The unique identification number is attached to the piece of equipment.

The laboratory performs analyses using state of the art equipment. In addition to the major equipment, the most common equipment used in the laboratory are: thermometers, balances, autopipets, water baths, hot plates, autoclaves, pH meters, conductivity meters and a variety of labware. The SOPs list the calibration and verification requirements for all laboratory equipment used in measurements.

8.3 Laboratory Water

Laboratory water is purified from central DI water systems and piped to all laboratory areas. In Westboro, the QA Department samples the laboratory grade water and submits the samples for analysis by the lab to document the water meets the drinking water certification criteria. The Laboratory Water Logbook lists the daily conductivity checks and acceptance criteria for the laboratory water. The laboratory documents the daily, monthly and annual water quality checks. Please refer to Table 8-1 for tested parameters, monitoring frequency and control limits for each parameter (SOP/08-11). Additional parameters may be tested for at the laboratory's discretion.

When additional treatment occurs in the test area, that test area records the water quality checks from the most frequently used tap. At a minimum the quality of the laboratory grade water is monitored daily by conductivity measurements. Records of the daily checks are found in the Laboratory Water Logbook. If out of specification results occur, a nonconformance action form is submitted.

TABLE 8-1 (Westboro Water)

Parameter	Monitoring Frequency	Control Limits
Conductivity	Daily	<2 µmhos/cm @ 25°C
pH	Daily	5.5 - 7.5
Total Organic Carbon	Monthly	< 1.0 mg/L
Total Residual Chlorine	Monthly	< detection limit
Ammonia Nitrogen	Monthly	< 0.1 mg/L
Metals: Cd, Cr, Cu, Pb, Ni and Zn	Monthly (Required Annually)	< 0.05 mg/L
Total Metals	Monthly (Required Annually)	< 0.1 mg/L
Heterotrophic Plate Count Westboro only	Monthly	< 500 CFU/mL
Water Quality Test (Biosuitability) Westboro only	Annually	0.8 – 3.0 ratio

8.4 Reference Materials

Reference materials include: Class 1 weights, NIST thermometers and reference standards. Logbooks record the reference materials used for calibration and verification. The Department Manager maintains any certificates received with the reference materials. Laboratory personnel record in the standards logbook the reference standards date received, unique identification number, expiration date and number of containers. Each laboratory area, records the unique identifier on the reference standard certificate and the Department Manager maintains the certificate. The identifier allows traceability from the certificate to the analytical data.

9 Measurement Traceability and Calibration

9.1 General Requirements

All measuring operations and testing equipment having an effect on the accuracy or validity of tests are calibrated and/or verified before put into service and on a continuing basis. The results are recorded in the instrument specific logbook. The laboratory has a program for the calibration and verification of its measuring and test equipment. The program includes all major equipment and minor equipment such as balances, thermometers and control standards. The Quality Systems Manual and method SOP describe the calibration records, frequency and personnel responsibilities.

9.2 Traceability of Calibration

The program of calibration and/or verification and validation of equipment is such that measurements are traceable to national standards, where available. Calibration certificates indicate the traceability to national standards, provide the results, and associated uncertainty of measurement and/or a statement of compliance with identified metrological specifications. A body that provides traceability to a national standard calibrates reference standards. The laboratory maintains a permanent file of all such certifications.

9.3 Reference Standards and Materials

Alpha Analytical has a program for calibration and verification of reference standards. The results and program are recorded in the appropriate instrument logbook. Required in-service checks between calibrations and verifications are described in method SOPs and are recorded in the appropriate instrument logbook.

Calibration standards are maintained within the area of consumption. A logbook of use is maintained and use is limited strictly to method required calibrations. Each calibration standard is identified as to test method used, date received, date opened, and expiration date. Calibrations are verified by using a second source or lot number of the calibration standard. Calibration check procedures are stated in applicable test method SOPs.

Reference standards of measurement in the laboratory's possession (such as calibration weights or traceable thermometers) are used for calibration only and for no other purpose.

9.4 Calibration General Requirements

Each calibration record is dated and labeled with method, instrument, analysis date, analyst(s) and each analyte name, concentration and response. For electronic processing systems that compute the calibration curve, the equation for the curve and the correlation coefficient are recorded in the appropriate instrument logbook. This is also true for manually prepared curves.

Initial calibration requires a standard curve that brackets the expected sample concentration. Initial calibration generally uses three to five standards depending on the equipment and reference method specifications. Before the start of each analytical sequence, initial calibration is verified by using a continuing calibration standard. Calibration verification or continuing calibration uses a standard from a second source or lot number than that used for initial calibration. The acceptance criteria for the continuing calibration standard must meet acceptance criteria before analysis of any samples. When the acceptance criteria is not within limits, review maintenance protocols and perform any necessary maintenance before starting the initial calibration sequence.

9.5 Equipment Calibration

The SOP used for the analysis defines the instrument and equipment calibration required. The following defines the general practices for equipment calibration of selected equipment.

9.5.1 Gas Chromatography/Mass Spectrometry (GC/MS)

The GC/MS is hardware tuned before performing the initial and continuing calibrations. Results must meet the peak ratio specifications of the analytical methods. For volatiles analyses, bromofluorobenzene (BFB) is used, and for semivolatiles analyses, decafluorotriphenylphosphine (DFTPP) is used for instrument tuning..

The mass spectrometer response is calibrated by analyzing a set of five or more initial calibration solutions, as appropriate, for each GC/MS method. Each solution is analyzed once, unless the method or the client requires multiple analyses. The relative response factor for each analyte is calculated for internal standard calibration. The calibration factor for external standard calibration is calculated using the expressions found in the laboratory method SOP. Calibration is acceptable when all acceptance criteria are within control limits.

The initial calibration is verified through the analysis of a continuing calibration standard every 12 hours. The concentration of the continuing calibration standard is dependent on the requirements of the specific method. The relative response factors for all analytes of interest are calculated and verified against the initial calibration mean relative response factors. The percent difference (%D) for each analyte is calculated and must be less than the acceptance criteria stated in the method.

An acceptable continuing calibration run must have measured percent differences for the analytes within method specified ranges. If any criteria for an acceptable calibration are not met, either instrument maintenance must be performed until the continuing calibration analysis meets all criteria or a new initial calibration is established before any samples are analyzed. No samples may be analyzed unless the acceptance criteria are met for the initial and continuing calibration.

Additional quality control samples are part of the GC/MS analysis. These include internal standards, surrogates, method blanks, instrument blanks, laboratory control samples, matrix spikes and matrix spike duplicates. The frequency and control criteria are defined in the laboratory SOP.

9.5.2 Gas Chromatography (GC)

Internal standard calibration or external standard calibration is utilized for analysis by GC. The method-specified number of calibration standards is used. Each solution is analyzed once and the analyte relative response factors or calibration factors are calculated. The mean relative response factor for each analyte is then obtained by using the expression in the formula listed in the SOP. Integrated areas are utilized for these expressions.

For multiple response pesticides, PCBs or hydrocarbons the quantitation consists of the average of selected peaks or the integration of the area defined by a reference standard. The SOP details the integration criteria for each compound.

The initial calibration is verified through the analysis of a continuing calibration standard every 12 hours or 20 samples. The concentration of the continuing calibration standard is dependent on the requirements of the specific method. The relative response factors for all analytes of interest are calculated and verified against the initial calibration mean relative response factors. The percent difference (%D) for each analyte is calculated. The percent drift (%d) may be calculated when calibration factors are used for quantitation.

An acceptable continuing calibration must have measured percent differences or percent drift for the analytes within method specified ranges. Should any criteria for an acceptable calibration not be met, either instrument maintenance is performed until the continuing calibration analysis meets all criteria, or a new calibration is established before any samples are analyzed. No samples may be analyzed unless the acceptance criteria are met for the initial and continuing calibration.

Other standard checks may be required for a specified reference method. Instrument performance checks specified in the reference method must be performed and be within the acceptance limits stated in the reference method. Additional quality control samples are part of the GC analysis. These include internal standards, surrogates, method blanks, instrument blanks, laboratory control samples, matrix spikes and matrix spike duplicates. The frequency and control criteria are defined in the laboratory SOP.

9.5.3 Cold Vapor Atomic Absorption Spectrophotometry (CVAA)

An initial calibration is performed daily with freshly prepared working standards that bracket the expected concentration range of the sample. A minimum of a three-point calibration curve is acquired which must have a correlation coefficient of 0.995 or better. The initial calibration is verified every 10 samples. The continuing calibration is required to be within method-defined criteria, depending on the analytical method employed. Continuing calibration blanks are run at the same frequency. Analysis of samples cannot begin until an initial calibration verification has been performed and is found to be within ± 10% of the true value.

9.5.4 Inductively Coupled Plasma Emission Spectrophotometry-Mass Spectrometry (ICP-MS)

Initial calibration and instrument tune is performed daily, not to exceed 24 hours, and continuing calibrations are performed every 10 samples. Initial calibration consists of a minimum of three standards and a Blank that bracket the expected concentration range of the samples. Analysis of samples cannot begin until an initial calibration verification has been performed and is found to be within method-defined criteria. The continuing calibration is required to be within method-defined criteria. Interference check standards are performed at the beginning of the sequence. Acceptance criteria are stated in the SOP.

9.5.5 Inductively Coupled Plasma Emission Spectrophotometry (ICP)

Initial calibration is performed daily, not to exceed 24 hours, and continuing calibrations are performed every 10 samples. Initial calibration consists of one standard and a Blank that bracket the expected concentration range of the samples. Analysis of samples cannot begin until an initial calibration verification has been performed and is found to be within 5% of the true value. The continuing calibration is required to be within 10% of the true value. Interference check standards are performed at the beginning and end of the sequence. Acceptance criteria are stated in the SOP.

9.5.6 Thermometers

Laboratory thermometers are checked annually for accuracy against certified, NIST traceable thermometers. Correction factors derived from the annual calibrations are applied to temperature readings where applicable. The analyst records the corrected temperature for all observations.

NIST traceable thermometers are calibrated professionally and re-certified every year. Records of thermometer calibrations are retained by the QA Department. All thermometers are tagged with the ID number, correction factor to be applied and the expiration of the calibration check.

NOTE: Electronic-based thermometers are calibrated on a quarterly basis by an outside instrument service company. Thermometers are tagged with calibration information by the vendor, including the ID number, correction factor to be applied and the expiration of the calibration check. Certificates are kept on file in the QA Department.

Thermometers are not used past the calibration expiration date or if the thermometer is not reading properly. Replacement thermometers are calibrated and the maintenance logbook is updated when a change in the thermometer is required due to breakage, damage or expired calibration.

9.5.7 Balances

Calibration checks are performed for each day of use, for each balance. The calibration consists of a minimum of two weights, which bracket the weight to be measured. Additional calibration check procedures are performed on balances utilized in Microbiology laboratory. This additional procedure consists of a deflection test, which is performed to ensure that 100mg is detectable at a weight of 150 grams.

The balance logbook lists the acceptance criteria and performance criteria for the various balances used in the laboratory. Calibration weight measurements must meet the acceptance criteria listed on the record form.

Each balance is serviced and calibrated by a professional semi-annually. Balances are labeled with the balance number, date of service and the expiration date for the annual service check. The balance number used for any measurements requiring traceability is recorded with measurement data. Balances are not used past the expiration date or when the weight check is not within acceptable criteria. The accuracy of the calibration weights used by Alpha Analytical is verified annually by an accredited calibration service.

9.5.8 Automatic Pipettes

Delivery volumes for the automatic pipettes are checked and recorded gravimetrically before use and on a quarterly basis. The verification is performed at the volume of use or bracketing the volume range of use. The check must be within the criteria stated in the laboratory logbook.

Autopipette calibration is also performed once per year. Each pipette is checked throughout the volume range of use by measuring seven replicate volumes and weighing. Acceptance criteria for

continued use is 5% RSD and between 95.0-105 % recovery. Pipettes failing acceptance criteria are tagged and removed from service until repaired and the criteria are met, or discarded and replaced. Automatic pipettes are labeled with a unique ID number, volumes verified and expiration date.

9.5.9 Ion Chromatography

The ion chromatograph calibration is by analyzing a set of five or more initial calibration solutions, with concentrations of analytes appropriate to the analytical methods. The concentrations must bracket the expected concentration range of the samples analyzed. Procedures for verifying the calibration curve are method specific. The initial calibration is performed at the start of each day. The calibration curve is verified at least after every 20 samples.

9.5.10 pH Meters

pH meters are calibrated prior to use for each day of use. The meter is calibrated following the procedure for pH analysis. The records of the calibration are recorded in an instrument logbook or in the raw data for the analysis being performed. At least two buffer solutions that bracket the measurement range for the analysis are used for calibration. A second source check standard is used at the end of a run to verify meter stability. Buffer solutions used for calibration are NIST certified. Standard buffer solutions are not retained or re-used. The lot number of the buffer solutions is recorded in the data record to ensure traceability of the measurement to NIST.

9.5.11 Conductivity Meters

Three calibration standards of potassium chloride (KCL) solutions are analyzed annually on each instrument range. The calibration standards are used to verify instrument performance. The acceptance criteria are defined in the test SOP. If unacceptable performance is found, the cell is cleaned and rechecked. The cell is not used until satisfactory performance is achieved.

A single KCL standard solution is used to calibrate each range of the instrument. A second standard is used to check the calibration each day the meter is used. The check standard is near the measurement range for the samples to be analyzed. The acceptance criteria is ± 20% of the true value. The meter is labeled with expiration date for the annual calibration. A check standard that is NIST traceable is used to allow traceability. The check standard is performed at the end of the analysis run or at least after every 20 samples.

9.5.12 Autoclave

The date, contents, sterilization time and temperature, total cycle time and analyst's initials are recorded each time the autoclave is used. Autoclave cycles must be completed within 45 minutes when a 15 minute sterilization time is used. Autoclave timing mechanisms are checked quarterly with a stopwatch to verify timing controls. A maximum temperature thermometer is used with each cycle to ensure the sterilization temperature is reached.

Spore strips or ampoules are used weekly to confirm sterilization. BTSure ampoules are utilized as follows: An indicator ampoule is placed in most challenging area of sterilizer. Load is processed according to standard operating instructions. Remove from sterilizer and allow to cool for a minimum of 10 minutes. (Chemical indicator on label changes from green to black when processed.) Place the autoclaved indicator and un-autoclaved control indicator in an upright position in the plastic crusher provided. Gently squeeze crusher to break glass ampoules. Incubate both indicators at 55-60°C for 48 hours. Examine appearance for color change. Yellow color indicates bacterial growth. No color change indicates adequate sterilization.

Calibration is conducted and certified annually by an outside service provider and recorded. Certificates are kept on file. Routine maintenance includes cleaning the autoclave seal to ensure

freedom of caramelized media and cleaning drain screens to remove any debris buildup. For the efficient operation of the unit, overcrowding is avoided.

10 Test Methods and Standard Operating Procedures

10.1 Methods Documentation

Analysis consists of setting up proper instrument operating conditions, executing acceptable calibrations, monitoring instrument performance tests, analyzing prepared samples, and collecting data from the analyses. The test method SOP describes the instrumental analysis procedures, quality control frequencies and acceptance criteria. EPA accepted methods, national recognized methods or client-specified methods are the basis for performance criteria, instrument conditions and the steps of the procedure. The method performance requirements of the published methods are followed unless otherwise specified by the client.

The reference methods define the instrument operating conditions. In many of the reference methods, a range or general guidance on the operating conditions is defined. Documented modifications to the operating conditions clarify the reference methods or improve the quality of the results. In all cases where the method modifications are adopted, the performance criteria from the reference method must be met. Modifications to the operating conditions are stated in the SOP. Changes in the operating conditions made at the time of the analysis are documented in the appropriate laboratory or sequence log. A revision to the SOP takes place, when a day to day change in the operating condition improves performance for all matrices.

The laboratory SOPs include the operation of measurement equipment. The SOPs contain the following information, as applicable:

- The equipment used in the procedure, including equipment type
- Equipment calibration and process for obtaining the measurement from the calibration
- The step by step instructions to perform the measurement
- Acceptance criteria for the calibrations
- Corrective action for failed acceptance criteria, including assessment of previous calibration results
- The basis used for the calibration standards such as traceability to NIST or EPA or demonstration of comparability
- Frequency at which the equipment will be calibrated, adjusted and checked
- The records maintained to document the calibration and use of measurement equipment
- The calibration status for the equipment
- The environmental conditions necessary before measurement equipment may be calibrated or used for measurement
- Allowed adjustments to measurement equipment, including software, which will not invalidate the laboratory analysis
- Maintenance of the equipment and record keeping to track performance before and after maintenance is completed
- Define the standards, reagents and sample handling, interferences, preservation, and storage in order to assure measurement performance

10.2 Standard Operating Procedures (SOPs)

Alpha Analytical maintains SOPs that accurately reflect all phases of current laboratory activities such as assessing data integrity, nonconformance actions, handling customer complaints, sample receipt and storage, purchasing of all materials, and all test methods. These documents include equipment manuals provided by the manufacturer, internally written documents, and published methods with documented changes or modifications.

Copies of all SOPs are accessible to all personnel in either electronic or written form. The SOPs are organized in a standard format with the signatures of the approving authorities. Each SOP clearly indicates the effective date of the document and the issue number.

10.3 Laboratory Method Manual (s)

All SOPs are posted as secure documents on the Alpha Intranet. Directories are available for each laboratory and administrative area. Each SOP includes or references where applicable:

1) identification of the test method and where applicable;
2) applicable matrix or matrices;
3) method detection limit;
4) scope and application;
5) summary of method;
6) definitions;
7) interferences;
8) safety;
9) equipment and supplies
10) reagents and standards
11) sample collection, preservation, shipment and storage;
12) quality control;
13) calibration and standardization;
14) procedure;
15) calculations;
16) method performance;
17) pollution prevention;
18) data assessment and acceptance criteria for quality control measurements;
19) corrective actions for out-of-control data;
20) contingencies for handling out-of-control or unacceptable data;
21) waste management;
22) references; and
23) any tables, diagrams, flowcharts and validation data.

In cases where modifications to the published method have been made by the laboratory or where the referenced method is ambiguous or provides insufficient detail, these changes or clarifications are clearly described in the SOP.

10.4 Test Methods

The laboratory uses appropriate methods and procedures for all tests and related activities within its responsibility (including sampling, handling, transport and storage, preparation of items, estimation of uncertainty of measurement and analysis of test data). The method and procedures are consistent with the accuracy required, and with any standard specification relevant to the calibrations or tests concerned. When the use of mandated methods for a sample matrix is required, only those methods are used. Where methods are employed that are not required, the methods are fully documented and validated and are available to the client and other recipients of the relevant reports.

The client requests the reference method for sample analysis usually based on the regulatory program. The client services staff may assist the client with method selection when the client specifies the regulatory program, but is unsure of the correct method required. The Laboratory Director or Quality Assurance Officer recommends methods for non-regulatory programs. In all cases, recommendation of methods is based on client-defined method performance criteria. Client services may recommend a procedure that meets the client method performance criteria.

10.5 Method Validation/Initial Demonstration of Method Performance

Before acceptance and use of any method, satisfactory initial demonstration of method performance is required. In all cases, appropriate forms are completed and retained by the laboratory and made available upon request. All associated supporting data necessary to reproduce the analytical results is retained. Initial demonstration of method performance is completed each time there is a significant change in instrument type, personnel or method..

10.6 Sample Aliquots

The aliquot sampling process from a submitted sample is part of a test method. The laboratory uses documented and appropriate procedures and techniques to obtain representative sub-samples. Sample aliquots removed for analysis are homogenized and representative portions removed from the sample container. Personnel record observations made during aliquot sampling in the test method logbooks.

10.7 Data Verification

Calculations and data transfers are subject to appropriate checks. A second person recalculates all manual calculations. An independent qualified analyst also reviews the data. A Client Services representative reviews data for project and method performance requirements where applicable. A QA representative reviews data for project and method performance requirements when requested by a Client. Final report review is performed by an authorized company signatory.

For drinking water suppliers, every effort is made to notify the Client within 24-hours of obtaining valid data of any results that exceed any established maximum contaminant level or reportable concentration. Analyst or Department Supervisor notifies the Client Services Department of the sample number(s), Client name, analysis and sample results (preliminary or confirmed). The Client Services Department notifies the client.

The laboratory Report Generation and Approval SOP describes the practices to ensure that the reported data is free of transcription errors and calculation errors. Manually entered data into the LIMS is dual entered and checked by the LIMS to minimize transcription errors. The laboratory test method SOP describes the quality control measures used to assure method performance before reporting data.

10.8 Labeling of Standards and Reagents

The purchase, receipt and storage of consumable materials used for the technical operations of the laboratory include the following:

a) The laboratory retains records of manufacturer's statement of purity, of the origin, purity and traceability of all chemical and physical standards.

b) Original reagent containers are labeled with the date opened and the expiration date.

c) Detailed records are maintained on reagent and standards preparation. These records indicate traceability to purchased stocks or neat compounds and include the date of preparation and preparer's initials.

d) Where calibrations do not include the generation of a calibration curve, records show the calibration date and type of calibration standard used.

e) All prepared reagents and standards are uniquely identified and the contents are clearly identified with preparation date, concentration and preparer's initials.

10.9 Computers and Electronic Data Related Requirements

Computers or automated equipment are used for the capture, processing, manipulation, recording, reporting, storage or retrieval of test data. The laboratory ensures that computer software is documented and adequate. The goals of the software development methodology, existing system validations and the change control system are to ensure that:

the software systems perform the required functions accurately,

the users understand how to use the system, and

auditors can assure themselves of the validity of the analytical data.

The computer systems used at Alpha Analytical are purchased. A coordinated effort is made with the supplier to assure the computer operations meet the laboratory requirements for data integrity. Alpha Analytical has a formal validation program of its computer systems. The validation program is a comprehensive program to ensure data transmitted, reported or manipulated by electronic means is correct and free of errors. The validation and verification approach is separated into three areas.

1. New software is developed and validated using test data. Records of validation include the test data report, date and initials. Where formulas are part of the program, documentation includes manual verification of the final calculated values. New software includes the development of macros for spreadsheets and other tools using commercial software packages.

2. Reasons for changes to software are identified through flaws in existing documentation or the need to improve system processes and are documented on the Nonconformance Report. Final implementation of the change is documented on the nonconformance action form. The tracking and timelines of making the change is readily available. This process also provides the complete documentation of all software and electronic data reporting problems.

3. Verification of system integrity is through routine maintenance, protection from unauthorized access and electronic verification programs. Routine maintenance including system backups are performed on a scheduled basis. The backup process and password and access protections are defined in the Computer System Backup Control SOP/11-01 and Computer Security SOP/11-02. Electronic verification may be used to assure the commercially purchased software is performing at its original specifications. This includes virus checking of all network operation at least once per week. Documentation of all verification and maintenance operations is retained.

11 Sample Handling, Sample Acceptance Policy and Sample Receipt

The Sample Login and Custody procedures define the process for sample management from sample receipt through analysis and to disposal. These procedures detail the process for sample receipt, records and storage pending analysis.

Clients or Alpha's Couriers deliver samples to the laboratory during normal business hours. Sample receiving occurs in the sample management area.

Client service personnel place bottle orders. The orders are filled following the bottle order instruction form. Blanks are prepared as needed with minimal storage. All glass containers are packed to minimize or prevent breakage. The containers are placed in plastic coolers or shipping packages and Chain-of Custody forms, seals (if requested) and labels enclosed. The bottle order is shipped by third party, picked up by the client or client representative or delivered by Alpha courier to the client.

11.1 Sampling Supplies

11.1.1 Sample Containers

Sample containers provided by Alpha Analytical include labels, preservatives and a blank chain of custody form. Preservatives and containers are lot controlled and verified as appropriate for the indicated type of analysis.

Each lot of containers used for the collection of samples for microbiological analysis is checked for sterility prior to distribution. Sterility checks are performed by Microbiology staff and results recorded in Microbiology Sample Container Sterility Log.

11.1.2 Chain of Custody

Chain of custody forms must accompany all samples received by Alpha personnel. The chain of custody form indicates the sample origin and arrival at the laboratory and identifies the analyses requested.

11.1.3 Reagent Water

Alpha Analytical supplies laboratory pure water for field QC blanks. Water used for volatile organics must be free of volatile compounds below the method detection limit. The quality of the laboratory water is monitored for conductivity once per day. Additional water quality criteria may be monitored based on client specific requests. The water quality in the laboratory is monitored for chemical parameters as required by the EPA certification manual for drinking water (Water Quality Monitoring SOP/08-11).

11.2 Sample Tracking

Alpha Analytical uses an internal chain-of-custody in LIMs for sample tracking control purposes. When requested or required by regulation a legal custody program is used in addition to the routine laboratory practices. Legal custody practices must be arranged at the time of contractual commitment.

For legal custody the process must include complete and continuous records of the physical possession, storage, and disposal of sample containers, collected samples, sample aliquots, and sample extracts or digestates. For legal custody a sample is in someone's custody if:

1. It is in one's actual physical possession;
2. It is in one's view, after being in one's physical possession;
3. It is in one's physical possession and then locked up so that no one can tamper with it;
4. It is kept in a secured area, restricted to authorized personnel only.

The routine sample handling and tracking process includes unique identification of all sample containers, initials of the person removing the sample from the sample management area and documentation of the date of sample removal for disposal.

Samples are assigned a unique identification number from the LIMS program. Each sample container label includes a unique identifier for the container. The person handling the sample is recorded along with the unique identifier in the container tracking records in LIMS.

ALPHA ANALYTICAL utilizes a custom designed Laboratory Information Management System (LIMS) to uniquely identify and track samples and analytical data throughout the facility. The LIMS log-in, is initiated by the Sample Custodian when the following information is entered into the computer:

- Quote number (unique to the project if requested)
- Project name or description
- Analyses requested (per matrices received)
- Sample number (unique to this sample)
- Sample descriptions (client ID, including number of received containers)
- Date received
- Date(s) and time(s) collected
- Date analytical results are due
- Client's name and address
- Notation of special handling instructions
- Additional comments or instruction for the laboratory
- Purchase order number(s), if applicable

Alpha Job Numbers (Process for assigning numbers)

Alpha Job Numbers are unique #'s automatically designated by our LIMS computer system for every individual client project.

There are 3 parts to this number:

- All numbers start with the letter "L"
- The next two numbers are the last two numbers of the current year.
- The last five numbers are pulled sequentially by the LIMS as each Login personnel requests a new number for a job.

  For example.... L0904165 ---- Year 2009 and 4,165th job to be logged in this year.

  The Alpha Job Number then may contain as many extensions as there are individual samples in a job. L0904165-01 is the first sample, L0904165-02 is the second and so on. Each sample may contain as many as 26 containers as the containers are designated with the letters of the Alphabet, and each container receives it's own bar-coded label. For example, L0904165-09A is the first container of the 9th sample listed on a client's Chain of Custody.

Each container is labeled with a unique identifier, a label with a unique identifier number is placed on each sample container. Once labeled, the sample containers are placed in the appropriate storage area.

11.3 Sample Acceptance Policy

The sample management personnel check for proper sample labeling, preservation and handling at the time of arrival at the laboratory. The client and client services manager specifies the proper sample preservation, containers, cooling and other criteria on the project review form and in the LIMS. Sample management staff record all observations and immediate notify client services of any discrepancies or questions arising during sample receipt.

It is possible for samples or sample containers to be lost, damaged, or determined to be unsuitable, for whatever reason, after initial receipt at Alpha Analytical. The problem is brought to the attention of a client services manager who reports it to the client. Plans for disposition of the affected samples or container are agreed upon with the client, carried out, and recorded in the project records.

11.4 Sample Receipt Protocols

The sample management staff receives all samples. A unique job number is assigned to each shipment of samples received from a client. The in-house records for the incoming job, including the internal Chain-of -Custody, are initiated with a Sample Delivery Group (SDG) form. The client, and Alpha courier and/or the sample management personnel sign the sample custody form at the time of receipt at the laboratory. Samples received via overnight courier are signed on the bill of lading. The bill of lading, SDG form and the sample custody form are completed for external courier delivered samples.

The sample management staff examines the shipping containers, their contents, and accompanying client documentation. Information about the sample identification, the location, date and time of collection, collector's name, preservation type, sample type, presence and condition of custody seals, the state of preservation of the samples and other required information is noted on the SDG form. Any discrepancies in documentation or problems with sample condition such as appropriate sample containers, thermal preservation variation, holding times and adequate sample volumes are noted and brought to the attention of the client via the nonconformance action form. The Client Services Manager provides clarification or further instruction to the sample management staff on the processing of the samples that are incomplete or missing required information.

The sample management staff logs the samples in the LIMs and a durable label for each container is printed. The custodian attaches each label to the appropriate sample container. The following information is recorded for tracking internal custody: laboratory sample ID, client sample ID, sample matrix and storage location. Sample receipt and log-in specifically requires: date and time of laboratory receipt of sample(s); sample collection date; unique laboratory ID code; field ID code supplied by sample submitter; requested analyses; signature or initials of data logger; comments from inspection for sample acceptance or rejection and in some cases, sample bottle codes.

11.5 Storage Conditions

Alpha Analytical stores samples under proper environmental conditions to ensure their integrity and security. Samples are stored at temperatures that meet specifications of the methodology, regulatory agencies and client directives. Refrigerators are monitored and controlled to be within 4 ± 2°C. Chemical, temperature, holding times and container storage requirements are listed in the LIMS project database.

Client Quality Assurance Project Plans may list preservation requirements differing from the laboratory. The sample management staff reviews project information for projects specific handling. Addition of chemical preservative to sample containers normally is done in the field at the time of sampling. Chemical preservation and temperature preservation checks at the time of receipt are recorded except for volatile organic compounds, bacteria, sulfite, and dissolved oxygen preservation. Any differences from laboratory or client specific requirements are recorded on nonconformance action forms and contact made with the client by the Client Services Manager or designee.

Sample storage facilities are located within the sample management area, which is secured by locked doors. Internal chain-of-custody procedures and documentation pertaining to sample possession, removal from storage, and transfer are outlined in the sample custody procedure. Samples are returned to the sample management area after the sample portion is removed for analysis. Extracts and digestates are tracked and follow the same internal custody operation. Extracts and digestates are removed to the waste disposal area after analysis for proper disposal.

Sample storage precautions are used to ensure that cross contamination does not occur during sample storage. Refrigerator storage blanks are monitored for volatile compounds as necessary. The storage blank information allows the assessment of potential cross contamination in the sample storage refrigerator.

Temperatures of cold storage areas are monitored and recorded daily. Corrective action is done as necessary when temperatures are not within the control criteria. In the Westboro and Mansfield facilities, automated Data loggers are linked to thermocouples in custody refrigerators and freezers in the Sample Storage area as well as department standards/storage refrigerators and freezers. The Data logger is calibrated and certified by an outside vendor on a quarterly basis. Refrigerators and/or freezers not connected to the Data Logger system have temperatures measured with NIST traceable thermometers. Temperature records indicate the thermometer or sensor (Data logger) used for obtaining the measurement.

11.6 Sample Disposal

Samples are held for thirty days after the report is released to the client. Upon written client request samples are held for up to six months in an uncontrolled area. Requests for controlled sample storage must be arranged at the time of contractual commitment

An authorized waste carrier is contracted to pick up waste as needed and dispose of it, in accordance with all regulatory requirements. Post-analysis disposition of samples is dependent upon project specific requests. Remaining sample material may be returned to the client, safely discarded, or archived for a specific time prior to disposal. The waste disposal SOP defines the specific requirements for sample disposal and other waste disposal operations.

The sample management staff are responsible for the archival and disposal of raw samples, extracts and digestates. Raw and prepared samples may not be archived or disposed until all of the designated analyses are complete and resultant analytical data is sent to clients. Samples in storage are retained a minimum of 30 days after reporting the results to the client. Any samples requiring more than 30 days are archived.

When a client has requested the return of samples, the sample management staff prepares and ships the samples according to the same custody procedures in which the samples were received and following any client specified requirements. Protection of the samples during delivery is ensured by the implementation of special packaging procedures. Packages are delivered by a commercial carrier whose procedures for protecting the samples are not within the control of this laboratory. Clients are informed that a commercial carrier will deliver their samples if required.

12 Records

Alpha Analytical has a record system that produces accurate records, which document all laboratory activities. The laboratory retains records of all original observations, calculations and derived data, calibration records and a copy of the test for ten years minimum. The system retains records longer than the minimum upon the request of authorized clients, agencies or another regulator.

12.1 Record Keeping System and Design

The record keeping system allows reconstruction of laboratory processes that produced the analytical data of the sample.

a) The records include the names of personnel involved in sampling, preparation, calibration or testing.

b) Information relating to laboratory facilities equipment, analytical methods, and activities such as sample receipt, preparation, or data verification are documented.

c) The record keeping system provides retrieval of working files and archived records for inspection and verification purposes.

d) Documentation entries are signed or initialed by responsible staff.

e) Generated data requiring operator logging on appropriate logsheets or logbooks are recorded directly and legibly in permanent ink

f) Entries in records are not obliterated by any method. Corrections to errors are made by one line marked through the error. The person making the correction signs and dates the correction.

g) Data entry is minimized by electronic data transfer and ensuring the number of manual data transcriptions is reduced.

12.2 Records Management and Storage

1. Records including calibration and test equipment, certificates and reports are safely stored, held secure and in confidence to the client.
2. The laboratory maintains hardware and software necessary for reconstruction of data.
3. Records that are stored or generated by computers have hard copy or write-protected backup copies.
4. Alpha Analytical has established a record management system, for control of hard copy laboratory notebooks.
5. Access to archived information is carefully controlled and is limited to authorized personnel. These records are protected against fire, theft, loss, environmental deterioration, vermin, and in the case of electronic records, electronic or magnetic sources.
6. In the event that Alpha Analytical transfers ownership or goes out of business, there is a plan to ensure that the records are maintained or transferred according to the client's instructions. A plan will be developed to maintain continuity of our record keeping systems as requested and/or required by both state and federal laws.

Alpha Analytical retains all original hard copy or electronic raw data for calibrations, samples, and quality control measures for ten years, including:

1. Analysts work sheets and data output records,
2. Reference to the specific method,
3. Calculation steps including definition of symbols to reduce observations to a reportable value,
4. Copies of all final reports
5. Archived SOPs,
6. Correspondence relating to laboratory activities for a specific project,
7. All nonconformance action reports, audits and audit responses,
8. Proficiency test results and raw data,
9. Data review and cross checking.

The basic information to tie together analysis and peripherals such as strip charts, printouts, computer files, analytical notebooks and run logs for Alpha Analytical includes:

1. Unique ID code for each Laboratory sample or QC sample;
2. Date of analysis;
3. Instrument identification and operating conditions;
4. SOP reference and version;
5. Calculations;
6. Analyst or operator's initials/signature.

In addition, Alpha Analytical maintains records of:

1. Personnel qualifications, experience and training
2. Initial and continuing demonstration of proficiency for each analyst
3. A log of names, initials and signatures for all individuals who are responsible for signing or initialing any laboratory records.

12.3 Laboratory Sample Tracking

A record of all procedures to which a sample is subjected while in the possession of the laboratory is maintained. These include but are not limited to records pertaining to:

a) Sample preservation including appropriate sample container and compliance with holding time requirement; If the time of the sample collection is not provided, the laboratory must assume the most conservative time of day (i.e., earliest).

b) Sample identification, receipt, acceptance or rejection and log-in;

c) Sample storage and tracking including shipping receipts, transmittal forms, and internal routing and assignment records; this includes interlaboratory transfers of samples, extracts and digestates.

d) Sample preparation including cleanup and separation protocols, ID codes, volumes, weights, instrument printouts, meter readings, calculations, reagents;

e) Sample analysis;

f) Standard and reagent origin, receipt, preparation, and use;

g) Equipment receipt, use, specification, operating conditions and preventative maintenance;

h) Calibration criteria, frequency and acceptance criteria;

i) Data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions;

j) Method performance criteria including expected quality control requirements;

k) Quality control protocols and assessment;

l) Electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries;

m) Automated sample handling systems;

n) Records storage and retention; and

o) Disposal of hazardous samples including the date of sample or sub-sample disposal and the name of the responsible person.

p) The COC records account for all time periods associated with the samples.

q) The COC records include signatures of all individuals who had access to individual samples. Signatures (written or electronic) of all personnel who physically handle the samples. Time of day and calendar date of each transfer or handling procedure

r) Common carrier documents.

13 Laboratory Report Format and Contents

The Process Planning and Control Procedure details the recording and reporting of data as required by the client and in accordance with relevant environmental regulations.

Clients specify the report delivery and deliverables required for the work submitted. Report delivery includes standard turnaround and rush turnaround. Clients specify the delivery address or multiple addresses and method of delivery such as U.S. Mail, facsimile or electronic at the start of the project. Alpha Analytical provides data deliverables in hardcopy or electronic format. At the start of any project, the electronic deliverable formats required must be received before sample arrival.

Reporting packages are available for routine regulatory reporting requirements. Regulatory reporting packages include only the information requested by the regulatory agency. In addition to regulatory report packages, Alpha Analytical prepares a standard report format. The standard report format includes:

1. Title: "Certification of Analysis"
2. Name and address of the laboratory
3. Laboratory Job Number, page number and total number of pages included in the report.
4. Name and address of the client
5. Alpha sample number, Client identification, Sample location
6. Samples identified that do not meet the sample acceptance requirements for project.
7. Date of sample receipt, sample collection, analysis date and time, report date and analyst
8. Identification of data reported by subcontractors
9. Test name and EPA reference method number
10. Delivery method and sampling procedures when collected by lab personnel
11. Deviations or modifications that affect data quality
12. Statement that results relate only to the sample tested
13. Statement that report must be copied in full unless the laboratory provides written permission for partial copies
14. Glossary, References and limits of liability
15. Units of measure and reporting detection limit
16. Quality control data for: % Recovery surrogates, % Recovery of LCS, % RPD of LCSD, Blank analysis, % Recovery Matrix Spike, %RPD of Laboratory Duplicates, as applicable
17. Signature, title and date of report
18. A "Certificate/Approval Program Summary" page is included at the end of the report that identifies analytes for which Alpha Analytical holds certification and for those analytes reported that it does not. This summary also includes the certification numbers for either NELAP certified states, State certifications (e.g. Massachusetts laboratory certification identification number) and DoD certification identifications.

19. Alpha Analytical does not accept samples from private residents for drinking water analysis and therefore maximum contaminant levels are not necessary. If Alpha were to change it's policy and report drinking water samples, MCLs would be included with the report.

Results transmitted by facsimile or other electronic means include a statement of confidentiality and return of the materials at the laboratory's expense.

The laboratory notifies the client in writing of any circumstance that causes doubt on the validity of the results. The amended or modified report lists the change, reason for the change, affected page numbers, date of the amendment and authorized signature.

14 Outside Support Services and Supplies

When Alpha Analytical purchases outside services and supplies in support of tests, the laboratory uses only those outside services and supplies that are of adequate quality to maintain confidence in the tests.

The Purchasing SOP/13-01 describes approval and monitoring of all suppliers and subcontractors used by the laboratory. Where no independent assurance of the quality of outside support services or supplies is available, the laboratory ensures that purchased equipment, materials, and services comply with specifications by evaluating method performance before routine use.

The laboratory checks shipments upon receipt as complying with purchase specifications. The use of purchased equipment and consumables is only after the evaluation and compliance to the specifications is complete. The Purchasing SOP/13-01 describes the details for receipt and inspection of purchased product.

The Purchasing SOP describes the process for raising, review and placement of purchase orders. It is company policy to purchase from third party certified suppliers and subcontractors wherever possible. Purchases must be from suppliers approved by the Laboratory. Laboratory or sampling subcontractors specified by the client are noted as "Trial" on the purchase order. This identifies the subcontractor as a non-approved subcontractor.

The laboratory maintains list of approved vendors (Form 13-01) and subcontractors from whom it obtains support services or supplies required for tests.

14.1 Subcontracting Analytical Samples

Clients are advised, verbally and/or in writing, if any analyses will be subcontracted to another laboratory. Any testing covered under NELAC that requires subcontracting, will be subcontracted to another NELAC accredited laboratory for the tests to be performed. Any testing covered under the DOD QSM that requires subcontracting, will be subcontracted to another accredited DOD laboratory and must be project-specific approved from the DOD client before analysis begins. These requirements for DOD projects pertain to both Westboro and Mansfield facilities. Any subcontractors used for data to be submitted to the Louisiana Department of Environmental Quality must also be certified by Louisiana LELAP. The laboratory approves testing and sampling subcontractors by review of current state, national or other external parties' certifications or approvals. This document must indicate current approval for the subcontracted work. Any sample(s) needing special reports (*i.e.*, MCL exceedence) will be identified on the chain of custody when the laboratory subcontracts with another laboratory.

The Sample Receipt and Login Procedure describes the process for sample handling when subcontracting samples. The quotation form lists the subcontractor in order to notify the client of any subcontracted work. Client notification of subcontracted work is in writing before releasing samples to the subcontractor.

The review of subcontractor documents for completeness and meeting the specifications defined for the project follows the laboratory process for reporting and verification of process data. The person responsible for receiving the order reviews the information supplied by the subcontractor instead of the Department Supervisor.

15 Client Relations

15.1 Client Service

The majority of the client services occur from personnel in the administration, sample receiving and sampling areas. Client service involves inquiries into services offered, technical consulting, placing orders, and receiving orders, providing updates on the status of orders and completing orders. Personnel interacting with clients must document and review client specific project requirements. Call Tracker is used to document communications with clients (SOP/10-02). Personnel must document client interactions following the appropriate laboratory procedures. Each person must communicate deviations, modifications and client requests following the laboratory defined procedures.

15.2 Project Management

During staff meetings the laboratory management reviews requests for new work. The Operations Director and/or Laboratory Director addresses all capacity and capability issues. Where conflicts in workload arise, client notification is immediate. The Project Communication Form (PCF) contains the documentation of all project information. Cooperation between laboratory and client services staff allows direct communication and scheduling. Management arranges complex scheduling and coordination between departmental areas.

15.3 Complaint Processing

The laboratory staff documents all clients or other parties' complaints or concerns regarding the data quality or laboratory operations. The Nonconformance Report records complaints, correcting the concern, and resolving the concern with the client or other party. The process uses the same form and process as the nonconformance action process. Where repetitive corrective actions indicate a problem, an audit of the area, Customer Inquiriy and Complaint SOP/10-01 is immediate to ensure the corrective action has effectively solved the concern.

16 Appendix A – Definitions/References

The following definitions are from Appendix A of the 2003 NELAC Standard. The laboratory adopts these definitions for all work performed in the laboratory.

Acceptance Criteria: specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation: the process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory. In the context of the National Environmental Laboratory Accreditation Program (NELAP), this process is a voluntary one. (NELAC)

Accrediting Authority: the Territorial, State or Federal agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation. (NELAC)[1.4.2.3]

Accrediting Authority Review Board (AARB): five voting members from Federal and State Accrediting Authorities and one-non-voting member from USEPA, appointed by the NELAP Director, in consultation with the NELAC Board of Directors, for the purposes stated in 1.4.7.e (NELAC)[1.4.7]

Accuracy: the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS).

Aliquot: A discrete, measured, representative portion of a sample taken for analysis. (DoD; EPA QAD glossary).

Assessor Body: the organization that actually executes the accreditation process, i.e., receives and reviews accreditation applications, reviews QA documents, reviews proficiency testing results, performs on-site assessments, etc., whether EPA, the State, or contracted private party. (NELAC)

Analyst: the designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality. (NELAC)

Analyte: The specific chemicals or components for which a sample is analyzed; it may be a group of chemicals that belong to the same chemical family, and which are analyzed together. (EPA Risk Assessment Guide for Superfund; OSHA Glossary)

Applicant Laboratory or **Applicant:** the laboratory or organization applying for NELAP

Assessment: the evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of NELAC). (NELAC)

Assessment (Clarification): The evaluation process used to measure the performance or effectiveness of a system and its elements against specific criteria.

Assessment Criteria: the measures established by NELAC and applied in establishing the extent to which an applicant is in conformance with NELAC requirements. (NELAC)

Assessment Team: the group of people authorized to perform the on-site inspection and proficiency testing data evaluation required to establish whether an applicant meets the criteria for NELAP accreditation. (NELAC)

Assessor: one who performs on-site assessments of accrediting authorities and laboratories' capability and capacity for meeting NELAC requirements by examining the records and other physical evidence for each one of the tests for which accreditation has been requested. (NELAC)

Audit: a systematic evaluation to determine the conformance to quantitative and qualitative specifications of some operational function or activity. (EPA-QAD)

Batch: environmental samples, which are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A **preparation batch** is composed of one to 20 environmental samples of the same NELAC-defined matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An **analytical batch** is composed of prepared environmental samples (extracts, digestates or concentrates), which are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples. (NELAC Quality Systems Committee)

Blank: a sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. Blanks include:

Equipment Blank: a sample of analyte-free media, which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (NELAC)

Field Blank: blank prepared in the field by filling a clean container with pure de-ionized water and appropriate preservative, if any, for the specific sampling activity being undertaken. (EPA OSWER)

Instrument Blank: a clean sample (e.g. distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Method Blank; a sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses, (NELAC)

Reagent Blank: (method reagent blank): a sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps. (QAMS)

Blind Sample: a sub-sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst or laboratory's proficiency in the execution of the measurement process. (NELAC)

Calibration: set of operations which establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards. (VIM: 6.11)

1) In calibration of support equipment the values realized by standards are established through the use of Reference Standards that are traceable to the International System of Units (SI).

2) In calibration according to test methods, the values realized by standards are typically established through the use of Reference Materials that are either purchased by the Laboratory with a certificate of analysis or purity, or prepared by the Laboratory using support equipment that has been calibrated verified to meet specifications.

Calibration Range: The range of values (concentrations) between the lowest and highest calibration standards of a multi-level calibration curve. For metals analysis with a single-point calibration, the lowlevel calibration check standard and the high standard establish the linear calibration range, which lies within the linear dynamic range.

Calibration Curve: the graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (NELAC)

Calibration Method: a defined technical procedure for performing a calibration. (NELAC)

Calibration Standard: a substance or reference material used to calibrate an instrument. (QAMS)

Certified Reference Material (CRM): a reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30 - 2.2)

Chain of Custody Form: record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; collector; time of collection; preservation; and requested analyses. (NELAC)

Clean Air Act: the enabling legislation in 42 U.S.C. 7401 *et seq.*, Public Law 91-604, 84 Stat. 1676 Pub.L. 95-95, 91 Stat., 685 and Pub. L. 95-190, 91 Stat., 1399, as amended, empowering EPA to promulgate air quality standards, monitor and to enforce them. (NELAC)

Client: Any individual or organization for whom items or services are furnished or work performed in response to defined requirements and expectations. (ANSI/ASQ E4-2004)

Congener: A member of a class of related chemical compounds (e.g., PCBs, PCDDs)

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA/Superfund): the enabling legislation in 42 U.S.C. 9601-9675 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. 9601 et seq., to eliminate the health and environmental threats posed by hazardous waste sites. (NELAC)

Confidential Business Information (CBI): information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products. NELAC and its representatives agree to safeguarding identified CBI and to maintain all information identified as such in full confidentiality.

Confirmation: verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to:

Second column confirmation
Alternate wavelength
Dervitization
Mass spectral interpretation
Alternative detectors or
Additional cleanup procedures.
(NELAC)

Conformance: an affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ASQC E4-1994)

Consensus Standard: A standard established by a group representing a cross-section of a particular industry or trade, or a part thereof. (ANSI/ASQ ANSI/ASQ E4-2004)

Continuing calibration verification: The verification of the initial calibration that is required during the course of analysis at periodic intervals. Continuing calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models. (IDQTF)

Contributor: a participant in NELAC who is not a Voting Member. Contributors include representatives of laboratories, manufacturers, industry, business, consumers, academia, laboratory associations, laboratory accreditation associations, counties, municipalities, and other political subdivisions, other federal and state officials not engaged in environmental activities, and other persons who are interested in the objectives and activities of NELAC.

Corrective Action: the action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

Critical Finding: a finding or a combination of findings that results in a significant negative effect on data quality or defensibility, if not corrected. (NELAC)

Data Audit: a qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality (i.e., that they meet specified acceptance criteria.) (NELAC)

Data Reduction: the process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form. (EPA-QAD)

Deficiency: See Finding and Critical Finding

Definitive Data: Analytical data of known quality, concentration, and level of uncertainty. The levels of quality and uncertainty of the analytical data are consistent with the requirements for the decision to be made. Suitable for final decision-making. (UFP-QAPP)

Delegate: any environmental official of the States or the Federal government not sitting in the House of Representatives, who is eligible to vote in the House of Delegates. (NELAC)

Demonstration of Capability: a procedure to establish the ability of the analyst to generate acceptable accuracy. (NELALC)

Denial: to refuse to accredit in total or in part a laboratory applying for initial accreditation or resubmission of initial application. (NELAC) [4.4.1]

Detection Limit: the lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. See Method Detection Limit. (NELAC) **Detection Limit (DL) (Clarification):** The smallest analyte concentration that can be demonstrated to be different from zero or a blank concentration at the 99% level of confidence. At the DL, the false positive rate (Type I error) is 1%.

Document Control: the act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed. (ASQC)

Environmental Data: Any measurements or information that describe environmental processes, locations, or conditions; ecological or health effects and consequences; or the performance of environmental technology. (ANSI/ASQ E4-2004)

Environmental Laboratory Advisory Board (ELAB): a Federal Advisory Committee, with members appointed by EPA and composed of a balance of non-state, non-federal representatives, from the environmental laboratory community, and chaired by an ELAB member. (NELAC)

Environmental Monitoring Management Council (EMMC): an EPA Committee consisting of EPA managers and scientists, organized into a Policy Council, a Steering Group, *ad hoc* Panels, and work groups addressing specific objectives, established to address EPA-wide monitoring issues. (NELAC)

False Negative: An analyte incorrectly reported as absent from the sample, resulting in potential risks from their presence.

False Positive: An item incorrectly identified as present in the sample, resulting in a high reporting value for the analyte of concern.

Federal Insecticide, Fungicide and Rodenticide Act (FIFRA): the enabling legislation under 7 U.S.C. 135 *et seq*., as amended, that empowers the EPA to register insecticides, fungicides, and rodenticides. (NELAC)

Federal Water Pollution Control Act (Clean Water Act, CWA): the enabling legislation under 33 U.S.C 1251 et seq., Public Law 92-50086 Stat. 8.16, that empowers EPA to set discharge limitations, write discharge permits, monitor, and bring enforcement action for non-compliance. (NELAC)

Field Measurement: The determination of physical, biological, or radiological properties, or chemical constituents; that are measured on-site, close in time and space to the matrices being sampled/measured, following accepted test methods. This testing is performed in the field outside of a fixed-laboratory or outside of an enclosed structure that meets the requirements of a mobile laboratory.

Field of Accreditation: (previously Field of Testing) NELAC's approach to accrediting laboratories by matrix, technology/method and analyte/analyte group. Laboratories requesting accreditation for a matrix-technology/method-analyte/analyte group combination or for an updated/improved method are required to submit only that portion of the accreditation process not previously addressed. (NELAC)

Field of Proficiency Testing: NELAC's approach to offering proficiency testing by matrix, technology, and analyte/analyte group.

Finding: an assessment conclusion, referenced to a NELAC Standard and supported by objective evidence that identifies a deviation from a NELAC requirement. **See Critical Finding.**

Finding (Clarification): An assessment conclusion that identifies a condition having a significant effect on an item or activity. An assessment finding may be positive or negative and is normally accompanied by specific examples of the observed condition (ANSI/ASQ E4-2004).

Governmental Laboratory: as used in these standards, a laboratory owned by a Federal, state or tribal government; includes government-owned contractor-operated laboratories. (NELAC)

Holding Times (Maximum Allowable Holding Times): the maximum times that samples may be held prior to analysis and still be considered valid or not compromised. (40 CFR part 136) **Holding Times (DoD Clarification):** The time elapsed from the time of sampling to the time of extraction or analysis, or from extraction to analysis, as appropriate.

Inspection: an activity such as measuring, examining, testing, or gauging one or more characteristics of an entity and comparing the results with specified requirements in order to establish whether conformance is achieved for each characteristic. (ANSI/ASQC E4-1994)

Interim Accreditation: temporary accreditation status for a laboratory that has met all accreditation criteria except for a pending on-site assessment which has been delayed for reasons beyond the control of the laboratory. (NELAC)

Internal Standard: a known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method. (NELAC)

Isomer: One of two or more compounds, radicals, or ions that contain the same number of atoms of the same elements but differ in structural arrangement and properties. For example, hexane (C6H14) could be n-hexane, 2-methylpentane, 3-methylpentane, 2,3-dimethylbutane, 2,2-dimethylbutane.

Laboratory: Body that calibrates and/or tests. (ISO 25)

Laboratory Control Sample (however named, such as laboratory fortified blank , spiked blank or QC check sample): a sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system. (NELAC).

Laboratory Duplicate: aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently. (NELAC)

Legal Chain of Custody Protocols: procedures employed to record the possession of samples from the time of sampling until analysis and are performed at the special request of the client. These protocols include the use of a Chain of Custody Form that documents the collection, transport, and receipt of compliance samples by the laboratory. **In addition, these protocols document all handling of the samples within the laboratory.** (NELAC)

Limit of Detection (LOD): An estimate of the minimum amount of a substance that an analytical process can reliably detect. A LOD is analyte-and-matrix-specific and may be laboratory-dependent.

Limit of Detection (Clarification): The smallest amount or concentration of a substance that must be present in a sample in order to be detected at a high level of confidence (99%). At the LOD, the false negative rate (Type II error) is 1%.

Limits of Quantitation (LOQ): The minimum levels, concentrations, or quantities of a target variable (e.g. target analyte) that can be reported with a specified degree of confidence.

Limit of Quantitation (Clarification): The lowest concentration that produces a quantitative result within specified limits of precision and bias. For DoD projects, the LOQ shall be set at or above the concentration of the lowest initial calibration standard.

Manager (however named): the individual designated as being responsible for the overall operation, all personnel, and the physical plant of the environmental laboratory. A supervisor may report to the manager. In some cases, the supervisor and the manager may be the same individual. (NELAC)

Management: Those individuals directly responsible and accountable for planning, implementing, and assessing work. (ANSI/ASQ E4-2004)

Management System: System to establish policy and objectives and to achieve those objectives (ISO 9000)

Matrix: the substrate of a test sample.

Field of Accreditation Matrix: these matrix definitions shall be used when accrediting a laboratory (see Field of Accreditation).

Drinking water: Any aqueous sample that has been designated a potable or potential potable water source.

Non-Potable Water: Any aqueous sample excluded from the definition of a drinking water matrix. Includes surface water, groundwater, effluents, water treatment chemicals, and TCLP or other extracts.

Solid and Chemical Materials: includes soils, sediments, sludges, products and by-products of an industrial process that results in a matrix not previously defined.

Biological Tissue: Any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.

Air and Emissions: whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbent tube, impinger solution, filter or other device. (NELAC)

Quality System Matrix: These matrix definitions are an expansion of the field of accreditation matrices and shall be used for purposes of batch and quality control requirements (see Appendix D of Chapter 5). These matrix distinctions shall be used:

Aqueous: any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.

Drinking water: Any aqueous sample that has been designated a potable or potential potable water source.

Saline/Estuarine: Any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.

Non-aqueous liquid: Any organic liquid with <15% settleable solids.

Biological Tissue: Any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.

Solids: Includes soils, sediments, sludges and other matrices with >15% settleable solids.

Chemical Waste: A product or by-product of an industrial process that results in a matrix not previously defined.

Air and Emissions: whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbent tube, impinger solution, filter or other device. (NELAC)

Matrix Spike (spiked sample, fortified sample): a sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of Target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency. (QAMS).

Matrix Spike Duplicate (spiked sample or fortified sample duplicate): a second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte. (QAMS).

May: denoted permitted action, but not required action. (NELAC)

Measurement Quality Objectives (MQOs): the desired sensitivity, range, precision, and bias of a measurement.

Measurement System: a test method, as implemented at a particular laboratory, and which includes the equipment used to perform the test and the operator(s).

Method: 1. See Test Method. 2. Logical sequence of operations, described generically, used in the performance of measurements. (VIM 2.4)

Method Detection Limit :one way to establish a Limit of Detection, defined as the minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

Method Detection Limit (MDL) (Clarification): The MDL is one way to establish a Detection Limit, not a Limit of Detection.

Method of Standard Additions: A set of procedures adding one or more increments of a standard solution to sample aliquots of the same size in order to overcome inherent matrix effects. The procedures encompass the extrapolation back to obtain the sample concentration. (This process is often called spiking the sample.) (Modified Skoog, Holler, and Nieman. Principles of Instrumental Analysis, 1998)

Mobile Laboratory: A portable enclosed structure with necessary and appropriate accommodation and environmental conditions as described in Chapter 5, within which testing is performed by analysts. Examples include but are not limited to trailers, vans and skid-mounted structures configured to house testing equipment and personnel.

Must: denotes a requirement that must be met. (Random House College Dictionary)

National Accreditation Database: the publicly accessible database listing the accreditation status of all laboratories participating in NELAP. (NELAC)

National Institute of Standards and Technology (NIST): an agency of the US Department of Commerce's Technology Administration that is working with EPA, States, NELAC, and other public and commercial entities to establish a system under which private sector companies and interested States can be accredited by NIST to provide NIST-traceable proficiency testing (PT) to those laboratories testing drinking water and wastewater. (NIST)

National Environmental Laboratory Accreditation Conference (NELAC): a voluntary organization of State and Federal environmental officials and interest groups purposed primarily to establish mutually acceptable standards for accrediting environmental laboratories. A subset of NELAP. (NELAC)

National Environmental Laboratory Accreditation Program (NELAP): the overall National Environmental Laboratory Accreditation Program of which NELAC is a part. (NELAC)

National Voluntary Laboratory Accreditation Program (NVLAP): a program administered by NIST that is used by providers of proficiency testing to gain accreditation for all compound/matrices for which NVLAP accreditation is available, and for which the provider intends to provide NELAP PT samples. (NELAC)

Negative Control: measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results. (NELAC)

NELAC Standards: the plan of procedures for consistently evaluating and documenting the ability of laboratories performing environmental measurements to meet nationally defined standards established by the National Environmental Laboratory Accreditation Conference. (NELAC)

NELAP Recognition: the determination by the NELAP Director that an accrediting authority meets the requirements of the NELAP and is authorized to grant NELAP accreditation to laboratories. (NELAC)

Performance Audit: the routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory. (NELAC)

Positive Control: measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects. (NELAC)

Precision: the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (NELAC).

Preservation: refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample. (NELAC)

Primary Accrediting Authority: the agency or department designated at the Territory, State or Federal level as the recognized authority with responsibility and accountability for granting NELAC accreditation for a specified field of testing. (NELAC)

Procedure: Specified way to carry out an activity or a process. Procedures can be documented or not. (ISO 9000: 2000 and Note 1)

Proficiency Testing: a means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (NELAC) [2.1]

Proficiency Testing Oversight Body/Proficiency Testing Provider Accreditor (PTOB/PTPA): an organization with technical expertise, administrative capacity and financial resources sufficient to implement and operate a national program of PT provider evaluation and oversight that meets the responsibilities and requirements established by the NELAC Standards. (NELAC)

Proficiency Testing Program: the aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories.

Proficiency Testing Study Provider: any person, private party, or government entity that meets stringent criteria to produce and distribute NELAC PT samples, evaluate study results against published performance criteria and report the results to the laboratories, primary accrediting authorities, PTOB/PTPA and NELAP. (NELAC)

Proficiency Test Sample (PT): a sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria . (QAMS).

Protocol: a detailed written procedure for field and/or laboratory operation (e.g., sampling, analysis) which must be strictly followed. (EPA-QAD)

Quality Assurance: an integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence. (QAMS).

Quality Assurance [Project] Plan (QAPP): a formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved. (EPA-QAD)

Quality Control: the overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users. (QAMS).

Quality Control Sample: a sample used to assess the performance of all or a portion of the measurement system. QC samples may be Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking.

Quality Systems Manual: A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, the ensure the quality of its product and the utility of its product to the users.

Quantitation Range: The range of values in a calibration curve between the LOQ and the highest successfully analyzed initial calibration standard. The quantitation range lies within the calibration range.

Quality System: a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC. (ANSI/ASQC E-41994)

Raw Data: any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments. If exact copies of raw data have been prepared (e.g., tapes which have been transcribed verbatim, data and verified accurate by signature), the exact copy or exact transcript may be submitted. (EPA–QAD)

Recognition: previously known as reciprocity. The mutual agreement of two or more parties (i.e. States) to accept each other's findings regarding the ability of environmental testing laboratories in meeting NELAC standards. (NELAC)

Reference Material: a material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (ISO Guide 30 - 2.1)

Reference Standard: a standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived. (VIM - 6.08)

Reference Toxicant: the toxicant used in performing toxicity tests to indicate the sensitivity of a test organism and to demonstrate the laboratory's ability to perform the test correctly and obtain consistent results (see Chapter 5, Appendix D, Section 2.1f). (NELAC)

Replicate Analyses: the measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval. (NELAC)

Requirement: Denotes a mandatory specification; often designated by the term "shall". (NELAC)

Resource Conservation and Recovery Act (RCRA): the enabling legislation under 42 USC 321 *et seq.* (1976), that gives EPA the authority to control hazardous waste from the "cradle-to-grave", including its generation, transportation, treatment, storage and disposal. (NELAC)

Revocation: the total or partial withdrawal of a laboratory's accreditation by the accrediting authority. (NELAC) [4.4.3]

Safe Drinking Water Act (SDWA): the enabling legislation, 42 USC 300f *et seq.* (1974), (Public Law 93-523), that requires the EPA to protect the quality of drinking water in the U.S. by setting maximum allowable contaminant levels, monitoring, and enforcing violations.

Sample Tracking: procedures employed to record the possession of the samples from the time of sampling until analysis, reporting and archiving. These procedures include the use of a Chain of Custody Form that documents the collection, transport, and receipt of compliance samples to the laboratory. In addition, access to the laboratory is limited and controlled to protect the integrity of the samples. (NELAC)

Secondary Accrediting Authority: the Territorial, State or federal agency that grants NELAC accreditation to laboratories, based upon their accreditation by a NELAP-recognized Primary Accrediting Authority. See also **Recognition** and **Primary Accrediting Authority**. (NELCA)

Second source calibration verification (ICV): A standard obtained or prepared from a source independent of the source of standards for the initial calibration. Its concentration should be at or near the middle of the calibration range. It is done after the initial calibration.

Selectivity: (Analytical chemistry) the capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. (EPA-QAD)

Sensitivity: the capability of a test method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (NELAC)

Shall: denotes a requirement that is mandatory whenever the criterion for conformance with the specification requires that there be no deviation. This does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled. (ANSI)

Signal to Noise Ratio: The signal carries information about the analyte, while noise is made up of extraneous information that is unwanted because it degrades the accuracy and precision of an analysis and also places a lower limit on the amount of analyte that can be detected. In most measurements, the average strength of the noise is constant and independent of the magnitude of the signal. Thus, the effect of noise on the relative error of a measurement becomes greater and greater as the quantity being measured (producing the signal) decreases in magnitude. (Skoog, Holler, and Nieman. Principles of Instrumental Analysis. 1998)

Should: denotes a guideline or recommendation whenever noncompliance with the specification is permissible. (ANSI).

Standard Operating Procedures (SOPs): a written document which details the method of an operation, analysis or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks. (Glossary of Quality Assurance Terms, QAMS, 8/31/92).

Spike: a known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes. (NELAC)

Standard: the document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of NELAC and meets the approval requirements of NELAC procedures and policies. (ASQC)

Standard Operating Procedures (SOPs): a written document which details the method of an operation, analysis or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks. (QAMS)

Standard Method: a test method issued by an organization generally recognized as competent to do so.

Standardized Reference Material (SRM): a certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method.

Statistical Minimum Significant Difference (SMSD): the minimum difference between the control and a test concentration that is statistically significant; a measure of test sensitivity or power. The power of a test depends in part of the number of replicates per concentration, the significance level selected, e.g. 0.05, and the type of statistical analysis. If the variability remains constant, the sensitivity of the test increases as the number of replicates is increased. (NELAC)

Supervisor (however named): the individual(s) designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees, supply and instrument adequacy and upkeep, quality assurance/quality control duties and ascertaining that technical employees have the required balance of education, training and experience to perform the required analyses. (NELAC)

Surrogate: a substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes. (QAMS).

Suspension: temporary removal of a laboratory's accreditation for a defined period of time, which shall not exceed six months, to allow the laboratory time to correct deficiencies or area of non-compliance with the NELAC standards. (NELAC) [4.4.2]

Target Analytes: Analytes specifically named by a client (also called project-specific analytes). Technical Director: Individual(s) who has overall responsibility for the technical operation of the environmental testing laboratory. (NELAC)

Technical Director: individual(s) who has overall responsibility for the technical operation of the environmental testing laboratory. (NELAC).

Technology: a specific arrangement of analytical instruments, detection systems, and/or preparation techniques.

Test: a technical operation that consists of the determination of one or more characteristics or performance of a given product, material, equipment, organism, physical phenomenon, process or service according to a specified procedure. The result of a test is normally recorded in a document sometimes called a test report or a test certificate. (ISO/IEC Guide 2 - 12.1, amended)

Test Method: an adoption of a scientific technique for performing a specific measurement, as documented in a laboratory SOP or as published by a recognized authority.

Testing Laboratory: laboratory that performs tests. (ISO/IEC Guide 2 - 12.4)

Testing Sensitivity/Power: the minimum significant difference (MSD) between the control and test concentration that is statistically significant. It is dependent on the number of replicates per concentration, the selected significance level, and the type of statistical analysis (see Chapter 5, Appendix D, Section 2.4.a). (NELAC)

Tolerance Chart: A chart in which the plotted quality control data is assessed via a tolerance level (e.g. +/- 10% of a mean) based on the precision level judged acceptable to meet overall quality/data use requirements instead of a statistical acceptance criteria (e.g. +/- 3 sigma). (applies to radiobioassay laboratories). (ANSI)

Toxic Substances Control Act (TSCA): the enabling legislation in 15 USC 2601 et seq. (1976), the provides for testing, regulating, and screening all chemicals produced or imported into the United States for possible toxic effects prior to commercial manufacture. (NELAC)

Traceability: the property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons. (VIM - 6.12)

Tuning: A check and/or adjustment of instrument performance for mass spectrometry as required by the method.

United States Environmental Protection Agency (EPA): the federal governmental agency with responsibility for protecting public health and safeguarding and improving the natural environment (i.e. the air, water and land) upon which human life depends. (US-EPA)

Validation: the confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled.

Verification: confirmation by examination and provision of evidence that specified requirements have been met. (NELAC)

NOTE - In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment.

The result of verification leads to a decision either to restore in service, to perform adjustments, or to repair, or to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.

Voting Member: Officials in the employ of the Government of the United States, and the States, the Territories, the Possessions of the United States, or the District of Columbia and who are actively engaged in environmental regulatory programs or accreditation of environmental laboratories. (NELAC)

Work Cell: a well-defined group of analysts that together perform the method analysis. The members of the group and their specific functions within the work cell must be fully documented. (NELAC)

Working Range: the difference between the Limit of Quantitation and the upper limit of measurement system calibration.

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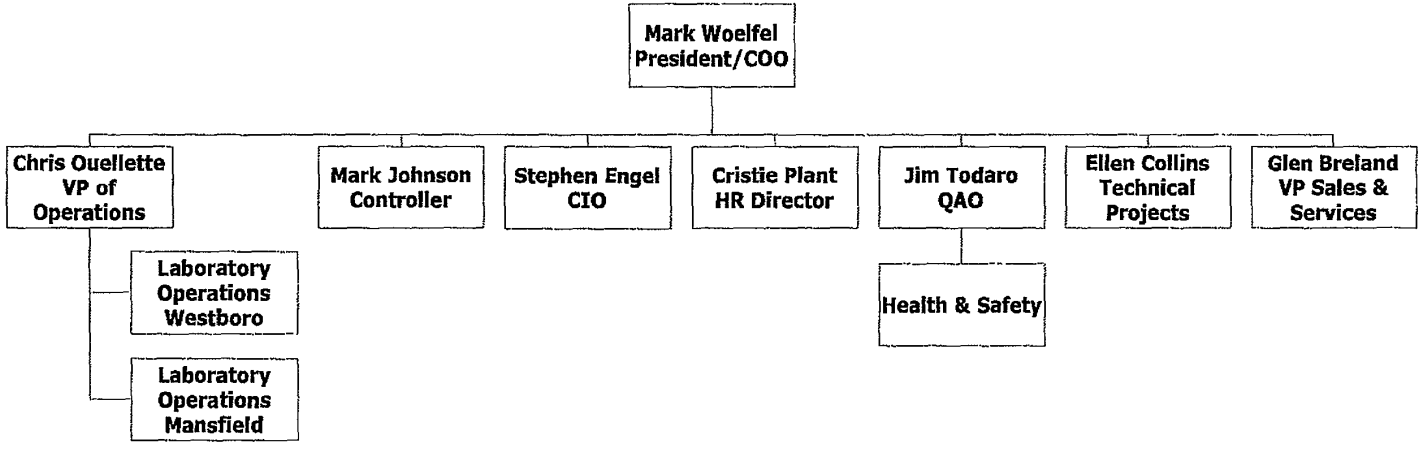
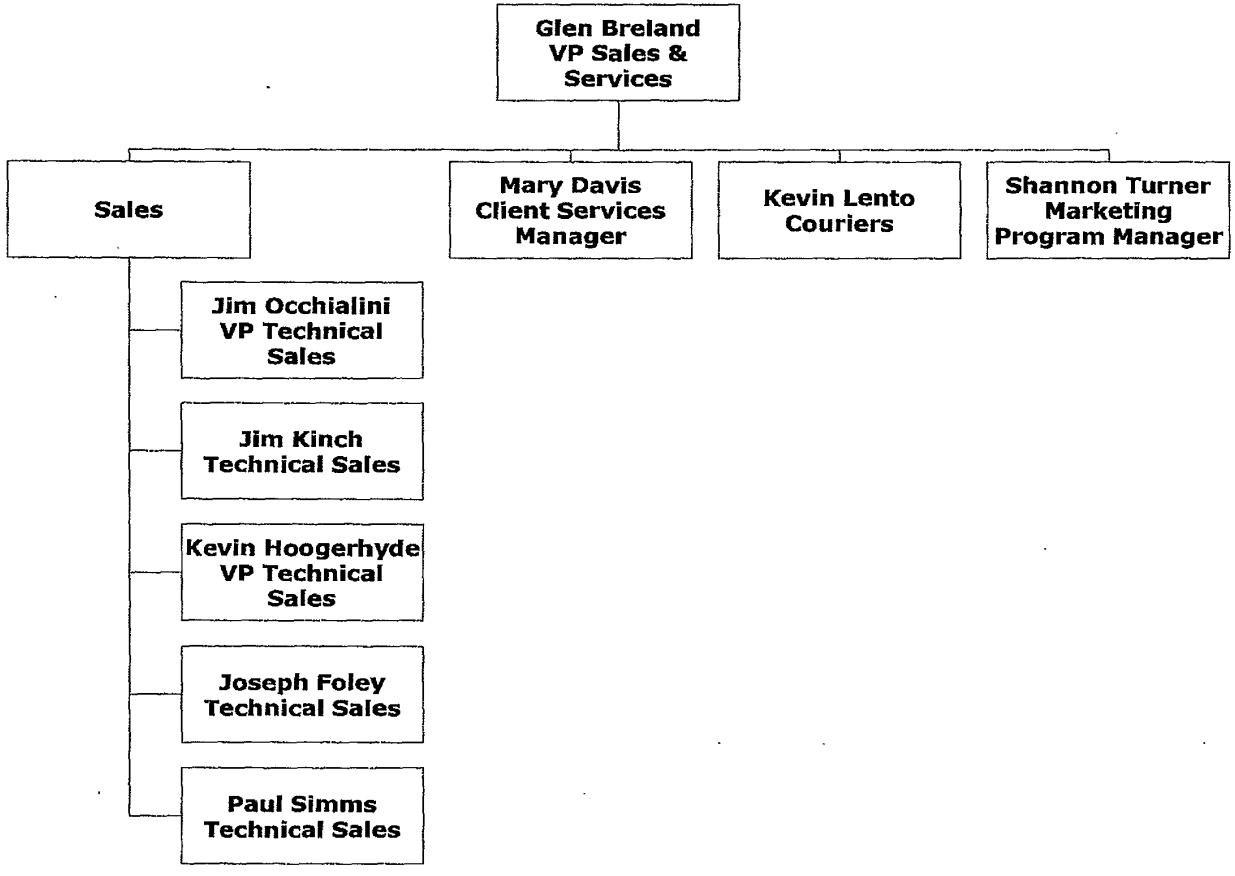
17 Appendix B – Organization Charts

The following charts provide an overview of the organizational structure of Alpha Analytical. The chart also identifies the key personnel responsible for the listed positions. For the various laboratory areas, the individual departmental supervisors are noted. For a listing of all current key personnel, please refer to Section 18, Appendix C.

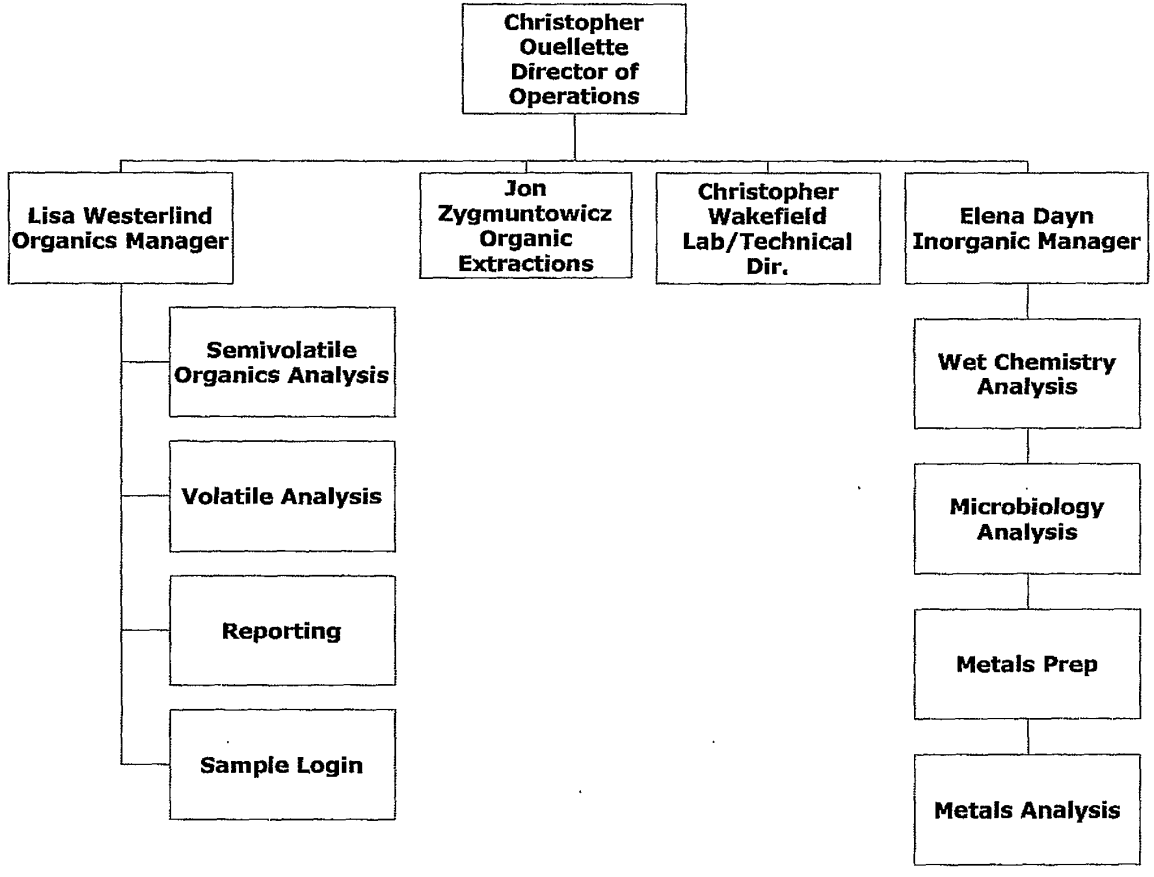
Alpha Analytical
Company Organizational Chart



Alpha Analytical
Sales and Services

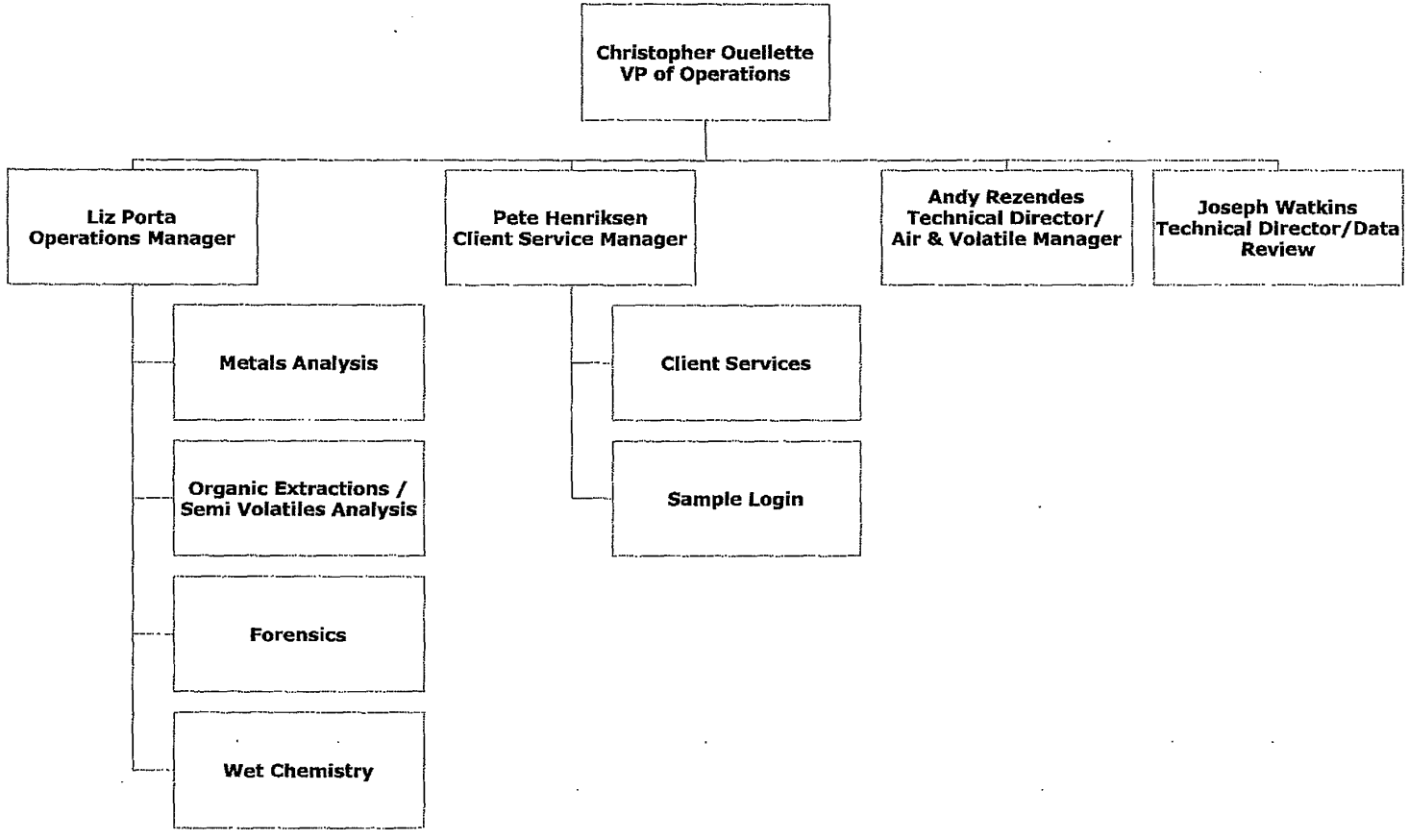


Alpha Analytical
Laboratory Organizational Chart
WESTBOROUGH



Alpha Analytical
Laboratory Organizational Chart

MANSFIELD



18 Appendix C – List of Key Personnel

The following is a listing of all current key personnel. If role is specific to a facility it is denoted by either Westboro or Mansfield following the position title. **Updated 07/19/2010**

President / Sales Manager: Mark Woelfel

Director of Operations: Christopher Ouellette

Laboratory Director / Technical Director, Westboro: Christopher Wakefield

Laboratory Director / Technical Director, Mansfield: Joseph Watkins

Quality Assurance Officer: James C. Todaro

Quality Systems Specialists: Amy Rice, Rene Bennett

VP, Technical Projects: Ellen Collins

Human Resources Director: Cristie Plant

Vice Presidents, Technical Sales: Glen Breland, James Occhialini

Technical Sales Reps: Jim Kinch, Kevin Hoogerhide; Paul Simms; Joe Foley

Controller: Mark Johnson

A/P, Purchasing: Jennifer Walters

Credit & Collections Supervisor: Holly Palmer

Chief Information Technology Officer: Stephen Engel

Information Technology: Glenn Fitzgibbons

VP, Sales and Services: Glen Breland

Client Services Manager, Westboro: Mary Davis

Client Services Manager, Mansfield: Peter Henriksen

Inorganics Department Manager, Westboro: Elena Dayn

Organics Department Manager, Login Manager, Westboro Lisa Westerlind

Organic Extractions Supervisor, Westboro: John Zygmuntowicz

Organic Technical Specialists: Scott Enright (Westboro), Cindy McQueen (Mansfield)

Air Technical Director/Volatiles Manager, Mansfield: Andy Rezendes

Operations Director, Mansfield: Elizabeth Porta

Data Review & Reporting Manager: Elizabeth Simmons

Equipment Maintenance: Gordon Tripp

Environmental Health & Safety Coordinator: Jeanette Soucy

Courier Manager: Kevin Lento

Hazardous Materials Consultant: Triumvirate

19 Appendix D – Preventive Maintenance Procedures

Optimized Service-Calibration Intervals		
Equipment	**Frequency**	**Type of Calibration or Maintenance**
Balances	semiannually daily	cleaning & operations check by service technician (external) calibration verification using Class S-1 certified weights
COD Reactor	annually annually	complete operations check by service technician (external) reaction temperature verification
Conductivity Bridge	annually each use	verification of cell constant complete operations check by service technician (external) calibration verification
DI Water System	as needed monthly annually daily	complete operations check by service technician (external) Residual Chlorine check Biosuitability testing (external) pH and Conductivity check
DO Meter	annually each use	complete operations check by service technician (external) calibration against air as specified by manufacturer
Emergency/Safety Equipment	annually monthly	fire extinguishers and emergency exit lighting check eye washes, showers, fire blanket and first aid kits checked
Freezers	daily	temperature verification
Gas Chromatographs	as needed as needed beginning and end of batch and 10 to 20 samples as per method	injection port preparation; cleaning of detectors initial multi-point calibration continuing calibration verification (CCV) against initial calibration
ICP	Every other day Daily Annually Annually As needed	Change pump tubing Calibration, profile Complete operations check by service technician (external), Linear Dynamic Range determination Clean torch, clean nebulizer, clean spray chamber
Lachat analyzer	Daily As needed	Calibration, clean lines Change tubing, change O-rings
Mass Spectrometers (GC & ICP)	bi-annually as needed 12 hour or daily	change of mechanical pump oil by service technician (external) cleaning of source BFB, DFTPP or ICP-MS tune analysis followed by ICAL or CCV
Mercury Analyzer	monthly each use	clean cell and change pump windings calibration using multi-point curve
Auto-pipettes	Monthly Annually	verification of accuracy verification of precision
Microwave	Quarterly Annually	power and temperature verification RPM verification
Ovens	annually daily	complete operations check by service technician (external) temperature verification
pH Meters	annually each use	complete operations check by service technician (external) calibration using certified buffers
Refrigerators (General Use)	daily	temperature verification
Refrigerators (Sample Management)	daily	temperature verification
Spectrophotometer	Semi-annually Semi-annually daily	cleaning & operations check by service technician (external) wavelength verification (external) continuing calibration verification (CCV) against initial calibration
TCLP Rotator	annually	RPM verification
Thermometers (Mercury/Alcohol)	annually	calibration against NIST traceable thermometer (internal)
Thermometers (digital)	Quarterly	calibration against NIST traceable thermometer (external)
Thermometer (NIST Traceable)	annually	calibration and certification of conformance (external)
Turbidity meter	annually each use	cleaning & operations check by service technician (external) calibration using formazin
Weights (Class S-1)	annually	service/calibration and certification of conformance (external)

20 Appendix E – List of Analytical Methods

Certificate/Approval Program Summary

Last revised July 19, 2010 - Westboro Facility

The following list includes only those analytes/methods for which certification/approval is currently held. For a complete listing of analytes for the referenced methods, please contact your Alpha Customer Service Representative.

Connecticut Department of Public Health Certificate/Lab ID: PH-0574. ***NELAP Accredited Solid Waste/Soil.***

Drinking Water (Inorganic Parameters: Color, pH, Turbidity, Conductivity, Alkalinity, Chloride, Free Residual Chlorine, Fluoride, Calcium Hardness, Sulfate, Nitrate, Nitrite, Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, Zinc, Total Dissolved Solids, Total Organic Carbon, Total Cyanide, Perchlorate. Organic Parameters: Volatile Organics 524.2, Total Trihalomethanes 524.2, 1,2-Dibromo-3-chloropropane (DBCP), Ethylene Dibromide (EDB), 1,4-Dioxane (Mod 8270). Microbiology Parameters: Total Coliform-MF mEndo (SM9222B), Total Coliform – Colilert (SM9223 P/A), E. Coli. – Colilert (SM9223 P/A), HPC – Pour Plate (SM9215B), Fecal Coliform – MF m-FC (SM9222D))
Wastewater/Non-Potable Water (Inorganic Parameters: Color, pH, Conductivity, Acidity, Alkalinity, Chloride, Total Residual Chlorine, Fluoride, Total Hardness, Silica, Sulfate, Sulfide, Ammonia, Kjeldahl Nitrogen, Nitrate, Nitrite, O-Phosphate, Total Phosphorus, Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chromium, Hexavalent Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Strontium, Thallium, Tin, Titanium, Vanadium, Zinc, Total Residue (Solids), Total Dissolved Solids, Total Suspended Solids (non-filterable), BOD, CBOD, COD, TOC, Total Cyanide, Phenolics, Foaming Agents (MBAS), Bromide, Oil and Grease. Organic Parameters: PCBs, Organochlorine Pesticides, Technical Chlordane, Toxaphene, 2,4-D, 2,4,5-T, 2,4,5-TP(Silvex), Acid Extractables (Phenols), Benzidines, Phthalate Esters, Nitrosamines, Nitroaromatics & Isophorone, Polynuclear Aromatic Hydrocarbons, Haloethers, Chlorinated Hydrocarbons, Volatile Organics, TPH (HEM/SGT), Extractable Petroleum Hydrocarbons (ETPH), MA-EPH, MA-VPH. Microbiology Parameters: Total Coliform – MF mEndo (SM9222B), Total Coliform – MTF (SM9221B), HPC – Pour Plate (SM9215B), Fecal Coliform – MF m-FC (SM9222D), Fecal Coliform – A-1 Broth (SM9221E).)
Solid Waste/Soil (Inorganic Parameters: pH, Sulfide, Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chromium, Hexavalent Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Tin, Vanadium, Zinc, Total Cyanide, Ignitability, Phenolics, Corrosivity, TCLP Leach (1311), SPLP Leach (1312 metals only), Reactivity. Organic Parameters: PCBs, PCBs in Oil, Organochlorine Pesticides, Technical Chlordane, Toxaphene, Extractable Petroleum Hydrocarbons (ETPH), MA-EPH, MA-VPH, Dicamba, 2,4-D, 2,4,5-T, 2,4,5-TP(Silvex), Volatile Organics, Acid Extractables (Phenols), 3.3'-Dichlorobenzidine, Phthalates, Nitrosamines, Nitroaromatics & Cyclic Ketones, PAHs, Haloethers, Chlorinated Hydrocarbons.)

Maine Department of Human Services Certificate/Lab ID: 2009024.
Drinking Water (Inorganic Parameters: SM9215B, 9222D, 9223B, EPA 180.1, 300.0, 353.2, SM2130B, 2320B, 4500Cl-D, 4500CN-C, 4500CN-E, 4500F-C, 4500H+B, 4500NO3-F, EPA 200.7, EPA 200.8, 245.1, EPA 300.0. Organic Parameters: 504.1, 524.2.)
Wastewater/Non-Potable Water (Inorganic Parameters: EPA 120.1, 1664A, 350.1, 351.1, 353.2, 410.4, 420.1, Lachat 10-107-06-1-B, SM2320B, 2340B, 2510B, 2540C, 2540D, 426C, 4500Cl-D, 4500Cl-E, 4500CN-C, 4500CN-E, 4500F-B, 4500F-C, 4500H+B, 4500Norg-B, 4500Norg-C, 4500NH3-B, 4500NH3-G, 4500NH3-H, 4500NO3-F, 4500P-B.5, 4500P-E, 5210B, 5220D, 5310C, EPA 200.7, 200.8, 245.1.

Organic Parameters: 608, 624, ME DRO, ME GRO, MA EPH, MA VPH.)
*Solid Waste/Soil (*Organic Parameters: ME DRO, ME GRO, MA EPH, MA VPH.)

Massachusetts Department of Environmental Protection Certificate/Lab ID: M-MA086.
Drinking Water
Inorganic Parameters: (EPA 200.8 for: Sb,As,Ba,Be,Cd,Cr,Cu,Pb,Ni,Se,Tl)
(EPA 200.7 for: Ba,Be,Ca,Cd,Cr,Cu,Na,Ni) 245.1, (300.0 for: Nitrate-N, Fluoride, Sulfate)
353.2 for: Nitrate-N, Nitrite-N; SM4500NO3-F, 4500F-C, 4500CN-CE, EPA 180.1, SM2130B, SM4500Cl-D, 2320B, SM2540C, SM4500H-B.
Organic Parameters: (EPA 524.2 for: Trihalomethanes, Volatile Organics)
(504.1 for: 1,2-Dibromoethane, 1,2-Dibromo-3-Chloropropane), 314.0, 332.
Microbiology Parameters: SM9215B; ENZ. SUB. SM9223; MF-SM9222D
Non-Potable Water
Inorganic Parameters:, (EPA 200.8 for: Al,Sb,As,Be,Cd,Cr,Cu,Pb,Mn,Ni,Se,Ag,Tl,Zn)
(EPA 200.7 for: Al,Sb,As,Be,Cd,Cr,Co,Cu,Fe,Pb,Mn,Mo,Ni,Se,Ag,Sr,Ti,Tl, V,Zn,Ca,Mg,Na,K)
245.1, SM4500H,B, EPA 120.1, SM2510B, 2540C, 2540B, 2340B, 2320B, 4500CL-E, 4500F-BC, 426C, SM4500NH3-BH, (EPA 350.1 for: Ammonia-N), LACHAT 10-107-06-1-B for Ammonia-N, SM4500NO3-F, 353.2 for Nitrate-N, SM4500NH3-B,C-Titr, SM4500NH3-BC-NES, EPA 351.1, SM4500P-E, 4500P-B,E, 5220D, EPA 410.4, SM 5210B, 5310C, 4500CL-D, EPA 1664, SM14 510AC, EPA 420, SM4500-CN-CE, SM2540D.
Organic Parameters: (EPA 624 for Volatile Halocarbons, Volatile Aromatics)
(608 for: Chlordane, Aldrin, Dieldrin, DDD, DDE, DDT, Heptachlor, Heptachlor Epoxide, PCBs-Water), EPA 625 for SVOC Acid Extractables and SVOC Base/Neutral Extractables, 600/4-81-045-PCB-Oil.

New Hampshire Department of Environmental Services Certificate/Lab ID: 200307. ***NELAP Accredited.***
Drinking Water (Inorganic Parameters: SM6215B, 9222B, 9223B Colilert, EPA 200.7, 200.8, 245.2, 120.1, 300.0, 314.0, SM4500CN-E, 4500H+B, 4500NO3-F, 2320B, 2510B, 2540C, 4500F-C, 5310C, 2120B, EPA 331.0. Organic Parameters: 504.1, 524.2, SM6251B.)
Non-Potable Water (Inorganic Parameters: SM9222D, 9221B, 9222B, 9221E-EC, EPA 200.7, 200.8, 245.1, 245.2, SW-846 6010B, 6020, 7196A, 7470A, SM3500-CR-D, EPA 120.1, 300.0, 350.1, 351.1, 353.2, 420.1, 1664A, SW-846 9010, 9030, 9040B, SM426C, SM2310B, 2540B, 2540D, 4500H+B, 4500NH3-H, 4500NH3-E, 4500NO2-B, 4500P-E, 4500-S2-D, 5210B, 2320B, 2540C, 4500F-C, 5310C, 5540C, LACHAT 10-117-07-1-B, LACHAT 10-107-06-1-B, LACHAT 10-107-04-1-C, LACHAT 10-107-04-1-J, LACHAT 10-117-07-1-A, SM4500CL-E, LACHAT 10-204-00-1-A, LACHAT 10-107-06-2-D. Organic Parameters: SW-846 3005A, 3015A, 3510C, 5030B, 8021B, 8260B, 8270C, 8330, EPA 624, 625, 608, SW-846 8082, 8081A.)
Solid & Chemical Materials (Inorganic Parameters: SW-846 6010B, 7196A, 7471A, 7.3.3.2, 7.3.4.2, 1010, 1030, 9010, 9012A, 9014, 9030B, 9040, 9045C, 9050C, 1311, 3005A, 3050B, 3051A. Organic Parameters: SW-846 3540C, 3545, 3580A, 5030B, 5035, 8021B, 8260B, 8270C, 8330, 8151A, 8082, 8081A.)

New Jersey Department of Environmental Protection Certificate/Lab ID: MA935. ***NELAP Accredited.***
Drinking Water (Inorganic Parameters: SM9222B, 9221E, 9223B, 9215B, 4500NO3-F, 4500F-C, EPA 300.0, 200.7, 2540C, 2320B, 314.0, SM2120B, 2510B, 5310C, SM4500H-B, EPA 200.8, 245.2. Organic Parameters: 504.1, SM6251B, 524.2.)
Non-Potable Water (Inorganic Parameters: SM5210B, EPA 410.4, SM5220D, 4500Cl-D, EPA 300.0, SM2120B, SM4500F-BC, EPA 200.7, 351.1, LACHAT 10-107-06-2-D, EPA 353.2, SM4500NO3-F, 4500NO2-B, EPA 1664A, SM5310B, C or D, 4500-PE, EPA 420.1, SM4500P-B5+E, 2540B, 2540C, 2540D, EPA 120.1, SM2510B, SM15 426C, SM9221CE, 9222D, 9221B, 9222B, 9215B, 2310B, 2320B, 4500NH3-H, 4500-S D, EPA 350.1, SM5210B, SW-846 3015, 6020, 7470A, 5540C, 4500H-B, EPA 200.8, SM3500Cr-D, EPA 245.1, 245.2, SW-846 9040B, 3005A, EPA 6010B, 7196A, SW-846 9010B, 9030B. Organic Parameters: SW-846 8260B, 8270C, 3510C, EPA 608, 624, 625, SW-846 5030B, 8021B, 8081A, 8082, 8151A, 8330, NJ OQA-QAM-025 Rev.7.)
Solid & Chemical Materials (Inorganic Parameters: SW-846 9040B, 3005A, 6010B, 7196A, 5030B,

9010B, 9030B, 1030, 1311, 3050B, 3051, 7471A, 9014, 9012A, 9045C, 9050A, 9065. Organic Parameters: SW-846 8021B, 8081A, 8082, 8151A, 8330, 8260B, 8270C, 1311, 1312, 3540C, 3545, 3550B, 3580A, 5035L, 5035H, NJ OQA-QAM-025 Rev.7.)

New York Department of Health Certificate/Lab ID: 11148. ***NELAP Accredited.***
Drinking Water (Inorganic Parameters: SM9223B, 9222B, 9215B, EPA 200.8, 200.7, 245.2, SM5310C, EPA 314.0, 332.0, SM2320B, EPA 300.0, SM2120B, 4500CN-E, 4500F-C, 4500H-B, 4500NO3-F, 2540C, EPA 120.1, SM 2510B. Organic Parameters: EPA 524.2, 504.1.)
Non-Potable Water (Inorganic Parameters: SM9221E, 9222D, 9221B, 9222B, 9215B, 5210B, EPA 410.4, SM5220D, 2310B-4a, 2320B, EPA 200.7, 300.0, LACHAT 10-117-07-1A or B, SM4500Cl-E, 4500F-C, SM15 426C, EPA 350.1, LACHAT 10-107-06-1-B, SM4500NH3-H, EPA 351.1, LACHAT 10-107-06-2, EPA 353.2, LACHAT 10-107-041-C, SM4500-NO3-F, 4500-NO2-B, 4500P-E, 2540C, 2540B, 2540D, EPA 200.8, EPA 6010B, 6020, EPA 7196A, S\M3500Cr-D, EPA 245.1, 245.2, 7470A, SM2120B, SM4500-CN-E LACHAT 10-204-00-1-A, EPA 9040B, SM4500-HB, EPA 1664A, SM5310C, EPA 420.1, SM14 510C, EPA 120.1, SM2510B, SM4500S-D, SM5540C, EPA 3005A, 3015. Organic Parameters: EPA 624, 8260B, 8270C, 625, 608, 8081A, 8151A, 8330, 8082, EPA 3510C, 5030B, 9010B, 9030B.)
Solid & Hazardous Waste (Inorganic Parameters: 1010, 1030, SW-846 Ch 7 Sec 7.3, EPA 6010B, 7196A, 7471A, 9012A, 9014, 9040B, 9045C, 9065, 9050, EPA 1311, 1312, 3005A, 3050B, 9010B, 9030B. Organic Parameters: EPA 8260B, 8270C, 8081A, 8151A, 8330, 8082, 3540C, 3545, 3546, 3580, 5030B, 5035.)

North Carolina Department of the Environment and Natural Resources Certificate/Lab ID : 666.
Organic Parameters: MA-EPH, MA-VPH.

Pennsylvania Department of Environmental Protection Certificate/Lab ID : 68-03671. ***NELAP Accredited.***
Non-Potable Water (Organic Parameters: EPA 3510C, 5030B, 625, 624. 608, 8081A, 8082, 8151A, 8260B, 8270C, 8330)
Solid & Hazardous Waste (Inorganic Parameters: EPA 1010, 1030, 1311, 3050B, 3051, 6010B, EPA 7.3.3.2, EPA 7.3.4.2, 7196A, 7471A, 9010B, 9012A, 9014, 9040B, 9045C, 9050, 9065. Organic Parameters: 3540C, 3545, 3580A, 5035, 8021B, 8081A, 8082, 8151A, 8260B, 8270C, 8330)

Rhode Island Department of Health Certificate/Lab ID: LAO00065. ***NELAP Accredited via NY-DOH.***
Refer to MA-DEP Certificate for Potable and Non-Potable Water.
Refer to NY-DOH Certificate for Potable and Non-Potable Water.

Texas Commisson on Environmental Quality Certificate/Lab ID: T104704476-09-1. ***NELAP Accredited.***
Non-Potable Water (Inorganic Parameters: EPA 120.1, 1664, 200.7, 200.8, 245.1, 245.2, 300.0, 350.1, 351.1, 353.2, 376.2, 410.4, 420.1, 6010, 6020, 7196, 7470, 9040, SM 2120B, 2310B, 2320B, 2510B, 2540B, 2540C, 2540D, 426C, 4500CL-E, 4500CN-E, 4500F-C, 4500H+B, 4500NH3-H, 4500NO2B, 4500P-E, 4500 S2- D, 510C, 5210B, 5220D, 5310C, 5540C. Organic Parameters: EPA 608, 624, 625, 8081, 8082, 8151, 8260, 8270, 8330.)

Solid & Hazardous Waste (Inorganic Parameters: EPA 1311, 1312, 9012, 9014, 9040, 9045, 9050, 9065.)

Department of Defense Certificate/Lab ID: L2217.
Drinking Water (Inorganic Parameters: SM 4500H-B. Organic Parameters: EPA 524.2, 504.1.)

Non-Potable Water (Inorganic Parameters: EPA 200.7, 200.8, 6010B, 6020, 245.1, 245.2, 7470A, 9040B, 300.0, 9251, 9038, 350.1, 353.2, 351.1, 120.1, 9050A , 410.4, 9060, 1664, 420.1, LACHAT 10-107-06-1-B, SM 4500CN-E, 4500H-B, 4500CL-E, 4500F-BC, 4500SO4-E, 426C, 4500NH3-B, 4500NH3-H, 4500NO3-F, 4500NO2-B, 4500Norg-C, 4500PE, 2510B, 5540C, 5220D, 5310C, 2540B, 2540C, 2540D, 510C, 4500S2-AD, 3005A, 3015, 9010B, 9030B. Organic Parameters: EPA 8260B, 8270C, 8330, 625, 8082, 8151A, 8081A, 3510C, 5030B, MassDEP EPH, MassDEP VPH.)

Solid & Hazardous Waste (Inorganic Parameters: EPA 200.7, 6010B, 7471A, 9040B, 9045C, 9065, 420.1, 9012A, 6860, 1311, 1312, 3050B, 9030B, 3051, 9010B, 3540C, SM 510ABC, 4500CN-CE, 2540G, SW-846 7.3, Organic Parameters: EPA 8260B, 8270C, 8330, 8082, 8081A, 8151A, 3545, 3546, 3580, 5035, MassDEP EPH, MassDEP VPH.)

Analytes Not Accredited by NELAP
Certification is not available by NELAP for the following analytes: **EPA 8260B:** Freon-113, 1,2,4,5-Tetramethylbenzene, 4-Ethyltoluene. **EPA 8330A:** PETN, Picric Acid, Nitroglycerine, 2,6-DANT, 2,4-DANT. **EPA 8270C:** Methyl naphthalene, Dimethyl naphthalene, Total Methylnapthalenes, Total Dimethylnaphthalenes, 1,4-Diphenylhydrazine (Azobenzene). **EPA 625:** 4-Chloroaniline. **EPA 350.1** for Ammonia in a Soil matrix.

Certificate/Approval Program Summary
Last revised July 19, 2010 – Mansfield Facility

The following list includes only those analytes/methods for which certification/approval is currently held. For a complete listing of analytes for the referenced methods, please contact your Alpha Customer Service Representative.

Connecticut Department of Public Health Certificate/Lab ID: PH-0141.

Wastewater/Non-Potable Water (Inorganic Parameters: pH, Turbidity, Conductivity, Alkalinity, Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Strontium, Thallium, Tin, Vanadium, Zinc, Total Residue (Solids), Total Suspended Solids (non-filterable), Total Cyanide. Organic Parameters: PCBs, Organochlorine Pesticides, Technical Chlordane, Toxaphene, Acid Extractables, Benzidines, Phthalate Esters, Nitrosamines, Nitroaromatics & Isophorone, PAHs, Haloethers, Chlorinated Hydrocarbons, Volatile Organics.)

Solid Waste/Soil (Inorganic Parameters: pH, Aluminum, Antimony, Arsenic, Barium, Beryllium, Cadmium, Calcium, Chromium, Hexavalent Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Potassium, Selenium, Silver, Sodium, Thallium, Vanadium, Zinc, Total Organic Carbon, Total Cyanide, Corrosivity, TCLP 1311. Organic Parameters: PCBs, Organochlorine Pesticides, Technical Chlordane, Toxaphene, Volatile Organics, Acid Extractables, Benzidines, Phthalates, Nitrosamines, Nitroaromatics & Cyclic Ketones, PAHs, Haloethers, Chlorinated Hydrocarbons.)

Florida Department of Health Certificate/Lab ID: E87814. ***NELAP Accredited.***

Non-Potable Water (Inorganic Parameters: SM2320B, EPA 120.1, SM2510B, EPA 245.1, EPA 150.1, EPA 160.2, SM2540D, EPA 335.2, SM2540G, EPA 180.1. Organic Parameters: EPA 625, 608.)

Solid & Chemical Materials (Inorganic Parameters: 6020, 7470, 7471, 9045, 9014. Organic Parameters: EPA 8260, 8270, 8082, 8081.)

Air & Emissions (EPA TO-15.)

Louisiana Department of Environmental Quality Certificate/Lab ID: 03090. ***NELAP Accredited.***

Non-Potable Water (Inorganic Parameters: EPA 120.1, 150.1, 160.2, 180.1, 200.8, 245.1, 310.1, 335.2, 608, 625, 1631, 3010, 3015, 3020, 6020, 9010, 9014, 9040, SM2320B, 2510B, 2540D, 2540G, 4500CN-E, 4500H-B, Organic Parameters: EPA 3510, 3580, 3630, 3640, 3660, 3665, 5030, 8015 (mod), 3570, 8081, 8082, 8260, 8270,)

Solid & Chemical Materials (Inorganic Parameters: 6020, 7196, 7470, 7471, 7474, 9010, 9014, 9040, 9045, 9060. Organic Parameters: EPA 8015 (mod), EPA 3570, 1311, 3050, 3051, 3060, 3580, 3630, 3640, 3660, 3665, 5035, 8081, 8082, 8260, 8270.)

Biological Tissue (Inorganic Parameters: EPA 6020. Organic Parameters: EPA 3570, 3510, 3610, 3630, 3640, 8270.)

Massachusetts Department of Environmental Protection Certificate/Lab ID: M-MA030.

Non-Potable Water (Inorganic Parameters: SM4500H+B. Organic Parameters: EPA 624.)

New Hampshire Department of Environmental Services Certificate/Lab ID: 2206. ***NELAP Accredited.***

Non-Potable Water (Inorganic Parameters: EPA 200.8, 245.1, 1631E, 120.1, 150.1, 180.1, 310.1, 335.2, 160.2, SM2540D, 2540G, 4500CN-E, 4500H+B, 2320B, 2510B. Organic Parameters: EPA 625, 608.)

New Jersey Department of Environmental Protection Certificate/Lab ID: MA015. ***NELAP Accredited.***

Non-Potable Water (Inorganic Parameters: SW-846 1312, 3010, 3020A, 3015, 6020, SM2320B, EPA 200.8, SM2540C, 2540D, 2540G, EPA 120.1, SM2510B, EPA 180.1, 245.1, 1631E, SW-846 9040B, 6020, 9010B, 9014 Organic Parameters: EPA 608, 625, SW-846 3510C, 3580A, 5030B, 3035L, 5035H, 3630C, 3640A, 3660B, 3665A, 8081A, 8082 8260B, 8270C)

Solid & Chemical Materials (Inorganic Parameters: SW-846 6020, 9010B, 9014, 1311, 1312, 3050B, 3051, 3060A, 7196A, 7470A, 7471A, 9045C, 9060. Organic Parameters: SW-846 3580A, 5030B, 3035L, 5035H, 3630C, 3640A, 3660B, 3665A, 8081A, 8082, 8260B, 8270C, 3570, 8015B.)

Atmospheric Organic Parameters (EPA TO-15)

Biological Tissue (Inorganic Parameters: SW-846 6020 Organic Parameters: SW-846 8270C, 3510C, 3570, 3610B, 3630C, 3640A)

New York Department of Health Certificate/Lab ID: 11627. ***NELAP Accredited.***

Non-Potable Water (Inorganic Parameters: EPA 310.1, SM2320B, EPA 365.2, 160.1, EPA 160.2, SM2540D, EPA 200.8, 6020, 1631E, 245.1, 335.2, 9014, 150.1, 9040B, 120.1, SM2510B, EPA 376.2, 180.1, 9010B. Organic Parameters: EPA 624, 8260B, 8270C, 608, 8081A, 625, 8082, 3510C, 3511, 5030B.)

Solid & Hazardous Waste (Inorganic Parameters: EPA 9040B, 9045C, SW-846 Ch7 Sec 7.3, EPA 6020, 7196A, 7471A, 7474, 9014, 9040B, 9045C, 9010B. Organic Parameters: EPA 8260B, 8270C, 8081A, DRO 8015B, 8082, 1311, 3050B, 3580, 3050B, 3035, 3570, 3051, 5035, 5030B.)

Air & Emissions (EPA TO-15.)

Rhode Island Department of Health Certificate/Lab ID: LAO00299. ***NELAP Accredited via LA-DEQ.***

Refer to MA-DEP Certificate for Non-Potable Water.

Refer to LA-DEQ Certificate for Non-Potable Water.

Texas Commission of Environmental Quality Certificate/Lab ID: T104704419-08-TX. ***NELAP Accredited.***

Solid & Chemical Materials (Inorganic Parameters: EPA 6020, 7470, 7471, 1311, 7196, 9014, 9040, 9045, 9060. Organic Parameters: EPA 8015, 8270, 8260, 8081, 8082.)

Air (Organic Parameters: EPA TO-15)

U.S. Army Corps of Engineers

Department of Defense Certificate/Lab ID: L2217.01.

Solid & Hazardous Waste (Inorganic Parameters: EPA 1311, 1312,3051, 6020, 747A, 7474, 9045C,9060, SM 2540G, ASTM D422-63. Organic Parameters: EPA 3580, 3570, 3540C, 5035, 8260B, 8270C, 8270 Alk-PAH, 8082, 8081A, 8015 (SHC), 8015 (DRO).

Air & Emissions (EPA TO-15.)

Analytes Not Accredited by NELAP
Certification is not available by NELAP for the following analytes: **8270C:** Biphenyl.

21 Appendix F – Alpha Code of Ethics Agreement

Alpha Analytical, Inc.
Ethical Conduct and Data Integrity Agreement

A. ***Personal Pledge:*** I understand that I am charged with meeting the highest degree of ethical standards in performing all of my duties and responsibilities and pledge to only report data, test results and conclusions that are accurate, precise and of the highest quality.

B. ***Protocol Pledges:*** I agree to adhere to the following protocols and principles of ethical conduct in fulfilling my work assignments at Alpha:

1. All work assigned to me will be performed using Standard Operating Procedures (SOPs) that are based on EPA approved methods or Alpha methods.
2. I will only report results or data that match the actual results observed or measured.
3. I will not intentionally nor improperly manipulate or falsify data in any manner, including both sample and QC data. Furthermore, I will not modify data values unless the modification can be technically justified through a measurable analytical process or method acceptable to Alpha. All such modifications will be clearly and thoroughly documented in the appropriate laboratory notebooks and raw data and include my initials or signature and date.
4. I will not intentionally report dates and times of analyses that are not the actual dates and times the analyses were conducted.
5. I will not intentionally represent another individual's work as my own or represent my work as someone else's.
6. I will not make false statements to, or seek to otherwise deceive Alpha staff, leaders or clients. I will not, through acts of commission, omission, erasure or destruction, improperly report measurements, standards results, data, test results or conclusions.

C. ***Guardian Pledge:***

1. I will not condone any accidental or intentional reporting of unauthentic data by other Alpha staff and will immediately report such occurrences to my supervisor, the QA Officer, the Laboratory Director or corporate leadership. I understand that failure to report such occurrences may subject me to immediate discipline, including termination.
2. If a supervisor or other member of the Alpha leadership group requests me to engage in, or perform an activity that I feel is compromising data validity or quality, I have the right to not comply with the request and appeal this action through Alpha's QA Officer, senior leadership or corporate officers, including the President of the company.
3. I understand that, if my job includes supervisory responsibilities, then I will not instruct, request or direct any subordinate to perform any laboratory practice that is unethical or improper. Also, I will not discourage, intimidate or inhibit a staff member who may

choose to appropriately appeal my supervisory instruction, request or directive that may be perceived to be improper, nor retaliate against those who do so.

D. ***Agreement Signature:*** I have read and fully understand all provisions of the *Alpha Analytical Ethical Conduct and Data Integrity Agreement.* I further realize and acknowledge my responsibility as an Alpha staff member to follow these standards. I clearly understand that adherence to these standards is a requirement of continued employment at Alpha.

_____
Employee Signature

_____
Printed Name

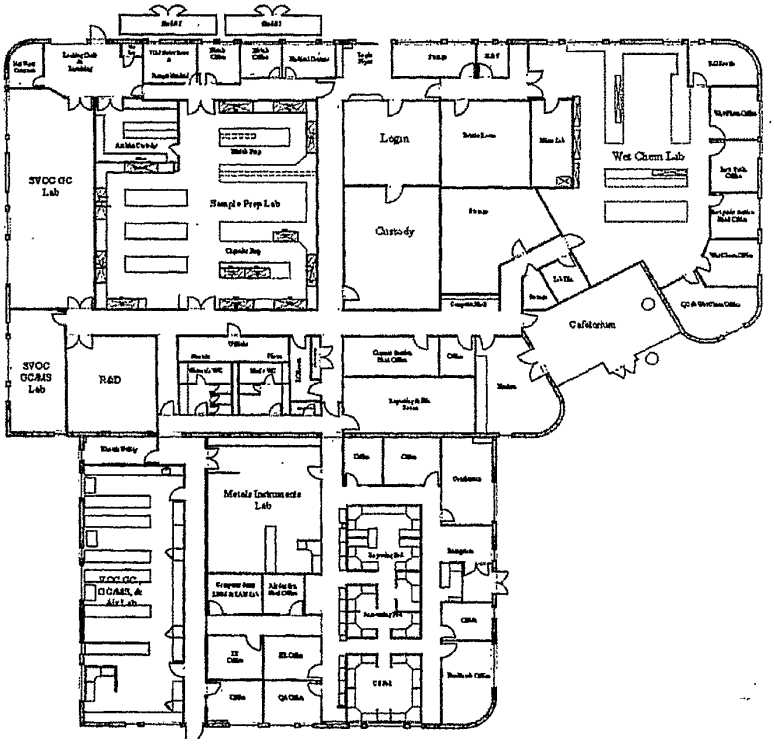
_____
Date

Review Requirements
The *Ethical Conduct and Data Integrity Agreement* must be signed at the time of hire (or within 2 weeks of a staff member's receipt of this policy). Furthermore, each staff member will be required to review and sign this agreement every year. Such signature is a condition of continued employment at Alpha. Failure to comply with these requirements will result in immediate discharge from Alpha employment. This agreement is not an employment contract and does not

22 Appendix G – Floor Plan Westboro Facility

Alpha Woods Hole Labs

FIGURE II
FLOOR PLAN



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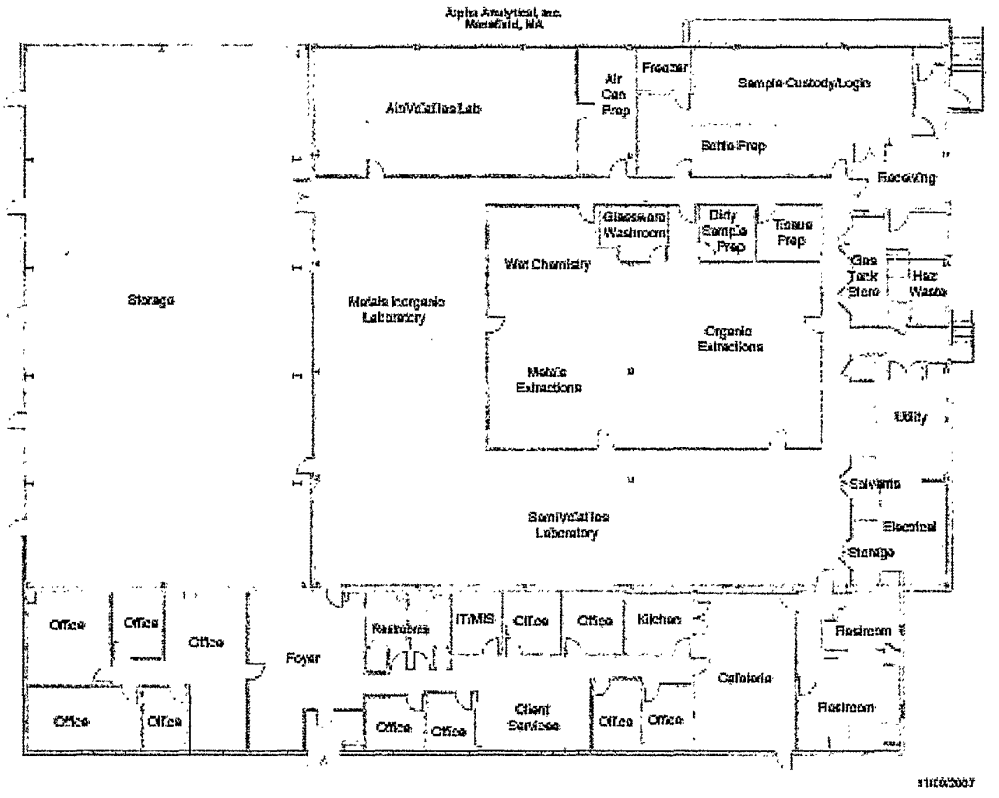
23 Appendix H– Floor Plan Mansfield Facility



24 Appendix I – Job Titles and Requirements

TITLE*	REQUIRED EDUCATION**	MINIMUM REQUIRED ENVIRONMENTAL LAB EXPERIENCE	MINIMUM REQUIRED SKILLS***
Technical Manager (Director) Organic Laboratory	BS or BA in Chemical, Environmental, or Biological Science; including minimum 24 credit hours in Chemistry. Masters or Doctoral degree in one of above disciplines may be susbsituted for 1 year of experience.	Two (2) years with the analysis of organic analytes in an environmental laboratory	1. Advanced technical knowledge of all analytical methods performed by the lab 2. Advanced technical instrumentation/lab systems knowledge 3. Knowledge of safe laboratory practices, OSHA regs and emergency protocols 4. Experience with and understanding of LIMS 5. Experience with method development and implementation 6. Experience monitoring standards of performance in Quality Control and Quality Assurance
Technical Manager (Director) Inorganic Laboratory	BS or BA in Chemical, Environmental, or Biological Science; including minimum 16 credit hours in Chemistry. Masters or Doctoral degree in one of above disciplines may be susbsituted for 1 year of experience.	Two (2) years with the analysis of inorganic analytes in an environmental laboratory	1. Advanced technical knowledge of all analytical methods performed by the lab 2. Advanced technical instrumentation/lab systems knowledge 3. Knowledge of safe laboratory practices, OSHA regs and emergency protocols 4. Experience with and understanding of LIMS 5. Experience with method development and implementation 6. Experience monitoring standards of performance in Quality Control and Quality Assurance
Technical Manager (Director) Microbiology Laboratory	BS or BA in Chemical, Environmental, or Biological Science; including minimum 16 credit hours in the Biological Sciences, including at least one course having microbiology as a major component. Masters or Doctoral degree in one of above disciplines may be susbsituted for 1 year of experience.	Two (2) years with the analysis of microbiological analytes in an environmental laboratory	1. Advanced technical knowledge of all analytical methods performed by the lab 2. Advanced technical instrumentation/lab systems knowledge 3. Knowledge of safe laboratory practices, OSHA regs and emergency protocols 4. Experience with and understanding of LIMS 5. Experience with method development and implementation 6. Experience monitoring standards of performance in Quality Control and Quality Assurance
Quality Assurance Director	BS/BA in Chemistry, Biology, Environmental or related Science	Two (2) years Environmental Laboratory Experience	1. Advanced technical knowledge of all analytical methods performed by the lab 2. Knowledgeable in Federal, State and DOD Programs (NELAC, etc.) 3. Able to develop QA/QC policies and certification requirements 4. Able to develop training programs for quality procedures 5. Documented training and/or experience in QA and QA procedures 6. Knowledge of safe laboratory practices and emergency protocols

TITLE*	REQUIRED EDUCATION**	MINIMUM REQUIRED ENVIRONMENTAL LAB EXPERIENCE	MINIMUM REQUIRED SKILLS***
Laboratory Coordinator	High School Diploma; Associates or BS/BA in Chemistry, Biology or Environmental or related Science preferred	1 year +	1. Knowledge of safe laboratory practices and emergency protocols 2. Proficient in all methods and SOP's within their department 3. Experience with and understanding of LIMS 4. Proven ability to meet TAT (turn around times)
Quality Systems Specialist	BS/BA Chemistry	2 years +	1. General knowledge of laboratory methods 2. Experience with and understanding of LIMS 3. Strong attention to detail 4. Strong oral/written communication and organizational skills 5. Knowledge of QA/QC policies and certification requirements
EH&S Coordinator	High School or Equivalent	2 years +	1. General knowledge of lab operations 2. Detailed knowledge of safe lab practices and emergency protocols 3. Hazardous Waste Management and RCRA Regulation Training 4. DOT Hazardous Materials Regulations Training 5. OSHA Compliance Training 6. Able to develop and deliver new hire and ongoing safety training programs
Lab Technician I	HS or Equivalent	0-1 years. 1+ years preferred.	1. Knowledge of safe laboratory practices 2. Able to follow direction and Standard Operating Procedures (SOP's) 3. Familiarity with standard and reagent preparation 4. Knowledgeable in using volumetric pipettes and glassware 5. Strong oral/written communication and organizational skills
Lab Technician II	HS or Equivalent	2-4 years	1. All skills of Lab Technician I 2. Trained in majority of technician skills relative to department
Lab Technician III	HS or Equivalent	5 years +	1. All skills of Lab Technician II 2. Experienced in training staff
Lab Technician/Chemist I	BS/BA in Chemistry, Biology, Environmental or related Science	0-1 years	1. Knowledge of safe laboratory practices 2. Able to follow direction and Standard Operating Procedures (SOP's) 3. Familiarity with standard and reagent preparation 4. Knowledgeable in using volumetric pipettes and glassware 5. Strong oral/written communication and organizational skills
Lab Technician/Chemist II	BS/BA in Chemistry, Biology, Environmental or related Science	2-4 years	1. All skills of Chemist I 2. Trained in majority of department methods

TITLE*	REQUIRED EDUCATION**	MINIMUM REQUIRED ENVIRONMENTAL LAB EXPERIENCE	MINIMUM REQUIRED SKILLS***
Lab Technician/Chemist III	BS/BA in Chemistry, Biology, Environmental or related Science	5 years +	1. All skills of Chemist II 2. Experienced in training staff
Analyst I	HS or Equivalent	0-1 years	1. Knowledge of safe laboratory practices 2. Able to follow direction and Standard Operating Procedures (SOP's) 3. Experienced with sample handling, preparation and/or extraction
Analyst II	HS or Equivalent	2-4 years	1. All skills of Analyst I 2. Experienced in machine operation, maintenance and troubleshooting
Analyst III	HS or Equivalent	5 years +	1. All skills of Analyst II 2. Experienced in data review and reporting 3. Experienced in training staff
Analytical Chemist I	BS/BA in Chemistry, Biology, Environmental or related Science	6 mos-1 year	1. Knowledge of safe laboratory practices 2. Able to follow direction and Standard Operating Procedures (SOP's) 3. Experienced with sample handling, preparation and/or extraction
Analytical Chemist II	BS/BA in Chemistry, Biology, Environmental or related Science	2-4 years	1. All skills of Analytical Chemist I 2. Experienced in machine operation, maintenance and troubleshooting
Analytical Chemist III	BS/BA in Chemistry, Biology, or Environmental or related Science	5 years +	1. All skills of Analytical Chemist II 2. Experienced in data review and reporting 3. Experienced in training staff
Data Deliverable Specialist I	HS Diploma, BS/BA or Associates preferred	0-1 years	1. Introductory knowledge of laboratory methods 2.Able to follow direction and Standard Operating Procedures (SOP's) 3. Working knowledge of Adobe Acrobat, Microsoft Workd, Excel 4. Good writing and typing skills
Data Deliverable Specialist II	HS Diploma, BS/BA or Associates preferred	2-4 years	1. All skills of Data Deliverable Specialist I 2. General knowledge of laboratory methods 3. Understanding of data review/ data reporting process 4. Experience with and understanding of LIMS and electronic data deliverables

TITLE*	REQUIRED EDUCATION**	MINIMUM REQUIRED ENVIRONMENTAL LAB EXPERIENCE	MINIMUM REQUIRED SKILLS***
Data Deliverable Specialist III	HS Diploma, BS/BA or Associates preferred	5 years +	1. All skills of Data Deliverable Specialist II 2. Intermediate/advanced knowledge of laboratory methods 3. Able to perform report review 4. Experience with and understanding of LIMS and electronic data deliverables 5. Able to initiate re-work where necessary
Laboratory Intern	2 Semesters of Chemistry, Biology or Environmental Science	None; Lab work study experience preferred	1. Knowledge of safe laboratory practices 2. Able to follow direction and Standard Operating Procedures

KEY

* Internal terms only. Full title would have "Environmental Laboratory" and specific department preceeding it.

** Substitutions: Equivalent knowledge may be substituted for a degree in some instances.

*** Not meant to be an exhaustive list of skill requirements. For full list of skills consult the "Laboratory Skills" list. Actual Job Duties and Responsibilities can be found within job descriptions for each position.

25 Appendix J – Standard Operating Procedures

WESTBORO SOP #	Title
02-02	Separatory Funnel Liquid-Liquid Extraction – EPA 3510C
02-03	Organic Extraction Glassware Cleaning & Handling
02-04	Soxhlet Extraction – EPA 3540C
02-09	Sulfur Cleanup – EPA 3660A
02-10	Oil and Waste Dilution – EPA 3580A
02-12	Microwave Extraction – EPA 3546
03-01	Volatile Organic Compounds – EPA 624
03-02	Volatile Organic Compounds – EPA 524.2
03-03	Volatile Organic Compounds – EPA 8260B
03-04	Polynuclear Aromatic Hydrocarbons (PAHs) by SIM – EPA 8270C (modified)
03-05	Semivolatile Organics by GC/MS – EPA 625
03-06	Semivolatile Organics by GC/MS – EPA 8270C
03-12	TCLP Extraction – Volatile Organics SW-846 Method 1311
04-02	EDB & DBCP in Water by Microextraction & Gas Chromatography – EPA 504.1
04-05	Organochlorine Pesticides by Capillary Column GC – EPA 8081
04-07	Extractable Petroleum Hydrocarbons
04-08	Volatile Petroleum Hydrocarbons
04-09	Organochlorine Pesticides & PCBs by Capillary Column GC – EPA 608
04-10	Polychlorinated Biphenyls in Oil – EPA 600/4-81-045
04-12	TPH-Diesel Range Organics, Maine 4.1.25, EPA 8015B (Modified)
04-13	TPH- Gasoline Range Organics, Maine 4.2.17, EPA 8015B (Modified)
04-14	CT-ETPH
04-16	Herbicides by 8151A
04-17	PCBs by Capillary Column Gas Chromatography - EPA 8082
04-20	New Jersey Method OQA-QAM-025 Rev. 7
04-21	New Jersey EPH Method
05-02	Microwave Assisted Acid Digestion of Aqueous Samples & Extracts – EPA 3015
05-03	TCLP Extraction Metals and Semi-Volatile Organics – SW-846 Method 1311

05-05	Hot Block Digestion for Aqueous Samples - EPA 3005A
05-07	Hot Plate Digestion of Sediments, Sludges and Soils, EPA 3050B
06-01	Metals by Inductively Coupled Plasma – EPA 6010B
06-02	Mercury in Liquid Waste by Cold-Vapor Atomic Absorption – EPA 7470A
06-03	Mercury in Soil or Solid Waste by Cold-Vapor AA – EPA 7471A
06-04	Metals by Inductively Coupled Plasma – EPA 200.7
06-06	Mercury in Water by Automated Cold-Vapor Atomic Absorption – EPA 245.1
06-10	Metals by Inductively Coupled Plasma-Mass Spectrometry – EPA 6020
06-11	Metals by Inductively Coupled Plasma-Mass Spectrometry – EPA 200.8
07-01	Enterococcus by Multiple Tube Technique – SM 9230B
07-02	Fecal Coliform by Membrane Filtration – SM 9222D
07-03	Fecal Coliform by Multiple Tube Fermentation – SM 9221E
07-04	Fecal Streptococcus by Multiple Tube Technique – SM 9230B
07-05	Heterotrophic Plate Count – SM 9215B
07-07	Total Coliform/E.Coli – Presence/Absence (Colilert) – SM 9223B
07-08	Total Coliform by Membrane Filtration – SM 9222B
07-09	Total Coliform by Multiple Tube Fermentation – SM 9221B
07-10	pH, Liquid Samples – EPA 9040B, SM 4500H$^+$-B
07-11	pH, Soil & Waste Samples – EPA 9045C
07-12	Hexavalent Chromium – EPA 7196A, SM 3500Cr-D
07-13	Biological Oxygen Demand – SM 5210B
07-14	Ammonia Nitrogen – SM 4500NH_3-BH, Lachat 10-107-06-1-A
07-15	Total Kjeldahl Nitrogen – EPA 351.1, SM 4500Norg-C, Lachat 10-107-06-2-D
07-16	Chemical Oxygen Demand – SM 5220D
07-17	Oil & Grease by n-Hexane Extraction Method & Gravimetry – EPA 1664
07-18	Cyanide, Total – EPA 9010B, SM 4500CN-CE
07-19	Phenol, Total - EPA 420.1, EPA 9065, SM 510AC
07-21	Sulfate, Turbidimetric Method – EPA 9038, SM 426C, SM 4500SO_4-E
07-22	Alkalinity, Titration Method – SM 2320B
07-23	Determination of Inorganic Anions by Ion Chromatography – EPA 300.0
07-24	Total Organic Carbon/Dissolved Organic Carbon – EPA 9060, SM 5310C
07-25	Chloride – SM 4500Cl-E, EPA 9251
07-26	Nitrate, Nitrite and Nitrate/Nitrite Nitrogen – EPA 353.2, SM 4500NO_3-F
07-27	Total Solids (Dried @ 103-105°) and TVS – SM 2540B, SM 2540E

07-28	Total Dissolved Solids – SM 2540C
07-29	Total Suspended Solids – SM 2540D
07-30	Total Sulfide – EPA 376.2, SM 4500S2-AD, EPA 9030B
07-31	MBAS, Anionic Surfactants – EPA 425.1, SM 5540C
07-32	Fluoride, Electrode Method – EPA 340.2, SM 4500F-BC
07-33	Turbidity, Nephelometric Method – EPA 180.1, SM 2130B
07-34	Orthophosphate, Colorimetric Single Reagent Method – SM 4500P-E
07-35	Total Phosphorous, Colorimetric Single Reagent Method – SM 4500P-E
07-36	Ignitability – EPA 1010
07-37	Reactivity – EPA Chapter 7.3
07-38	Total Solids (Dried @ 103-105°) – SM 2540G
07-39	Chlorophyll A – SM 10200H
07-41	E. Coli – Membrane Filtration
07-42	Chlorophyll A – EPA 446
07-43	Specific Conductance
07-44	True and Apparent Color, Visual Comparison Method
07-45	Acidity, Titration Method
07-46	Air Density Monitoring
07-48	Inhibitory Residue Test
07-51	Determination of Formaldehyde by HPLC, EPA 8315A
07-52	Enterococcus – MF
07-54	Sulfite, Iodometric
07-55	Ferrous Iron
07-56	Residual Chlorine
07-57	ORP
07-60	Ignitability of Solids EPA 1030
07-61	USP Total Organic Carbon Combustion Oxidation Method
07-63	Physiologically Available Cyanide (PAC)
07-64	Total Settleable Solids SM 2540 F
07-65	Fixed and Volatile Solids in Solid and Semisolid Samples – SM 2540G
07-66	Tannin & Lignin
07-69	Nitrite - Manual Colorimetric Method
07-70	Paint Filter Liquids Test
07-71	Total Coliform, E.Coli & Enterococcus by Quantification Methods (Quanti Tray)

07-72	Odor, Threshold Odor Test
07-73	Dissolved Oxygen
08-02	Balance Calibration Check
08-04	KD Tube Calibration Verification
08-06	Thermometer Calibration
08-08	Analytical Guidelines for Method Validation
08-10	Inorganics Glassware Cleaning and Handling
08-11	Water Quality Monitoring
08-18	Reagent, Solvent and Standard Control
10-02	Customer Service
10-03	Quote/Contract Procedure
10-04	Data Validation Package Generation
10-05	Project Communication Form Generation
13-02	Accounts Payable Invoice Processing
14-01	Waste Management and Disposal
18-01	Nitroaromatics and Nitramines by HPLC, EPA 8330A,B
18-03	Perchlorate by IC/MS/MS
MANSFIELD SOP #	**Title**
Chemistry	
M-001	Inductively Coupled Plasma – Mass Spectrometry by Method 6020
M-005	Mercury Determination by Cold Vapor AAS 245.1, 7470A
M-006	Mercury Determination by Cold Vapor SSA, 7471B
M-008	Acid Volatile Sulfides and Simultaneously Extracted Metals in Sediments
M-011	Hydride Generation ICP-MS
M-013	Mercury in Aqueous Samples by Cold Vapor Atomic Fluorescence Technique, 1631E/245.7/7474
M-014	Mercury in Tissue and Soil Samples by Cold Vapor Atomic Fluorescence Technique, 1631E/245.7/7474/7471A
M-015	Methylmercury in Tissue and Sediment Samples by HPLC CVAF
MP-001	Metals Soil/Sediment Digestion – ICP Method 3050:1T
MP-003	Microwave Assisted Acid Digestion of Sediments, Soils, Tissues and Waters, 3051/3015A
MP-004	Acid Digestion of Aqueous Samples for Metals Analysis, 3010A/3020A

MP-006	Seawater Extraction Procedure for Trace Metals
MP-007	Toxicity Characteristic Leaching Procedure, SW-846 Method 1311
O-004	Volatile Organic Compounds by GC/MS, Method 8260B and 624
O-006	Method 8270C – Semivolatile Organic Compounds by GC/MS
O-007	Analysis of PAH by GC/MS–SIM
O-011	Method 8081B-Organochlorine Pesticides by GC-ECD
O-012	Method 8082-PCBs as Aroclors or Congeners by GC-ECD
O-015	Determination of PCB Homologs, Individual Congeners, and Pesticides by GC/MS - SIM
O-016	1,4-Dioxane by GC/MS-SIM with Isotope Dilution Modification
OP-001	Extraction of Liquid Samples by Separatory Funnel- Method 3510C
OP-003	Tissue Preparation and Homogenization
OP-006	Gel Permeation Chromatography (GPC)
OP-007	Sulfur Cleanup with Copper – Method 3660B
OP-010	Sulfuric Acid Cleanup – Method 3665A
OP-014	Silica Fractionation Cleanup by HPLC
OP-015	Percent Lipid Determination
OP-016	Microscale Solvent Extraction (MSE)
OP-019	Soxhlet Extraction EPA 3540C
OP-020	Soxhlet Extraction of PUF Cartridges
W-001	Percent Solids Determination
W-002	Specific Conductance, Method SM2510B
W-003	pH in Water
W-004	pH in Soil and Waste
W-006	Total Suspended Solids (TSS) – Non-filterable Residue
W-007	Turbidity, Method 180.1
W-009	Alkalinity, Method 2320B
W-024	Hexavalent Chromium, SM 3500Cr-D/ 7196A
W-028	Total Organic Carbon in Soil, Sediment and Water
W-029	Particle Size Analysis
W-032	Particulates in Air Method PM-10
W-033	Volatile Solids in Solid and Semisolid Samples
G-002	Laboratory Glassware Cleaning
G-003	Balance Calibration and Maintenance

G-004	Gravimetric Testing of Pipettes
G-006	Hazardous Waste & Sample Disposal
G-008	Reagent, Solvent and Standard Control
A-001	Determination of VOCs in Ambient Air GC/MS- Method TO-15
A-002	Analysis of Air Samples for Helium via GC/TCD
A-003	APH
A-004	Air PIANO Volatiles
A-005	Dissolved Gases
A-007	Can Cleaning
A-008	Fixed Gases new system
A-009	TO-11A
MANSFIELD Forensics SOP #	**SOP Title**
O-003	Total Petroleum Hydrocarbons and Saturated Hydrocarbons by GC-FID
O-008	Analysis of Parent and Alkylated PAH by Selected Heterocyclic Compounds by GC/MS-SIM
O-018	Organic Lead by GC/MS SIM
O-019	PIANO Volatilles by GC/MS
O-020	Ethanol in Oil by GC/MS
O-021	Whole Oil Analysis by GC/MS and FID
O-022	Density Determination of Oils
OP-009	Alumina Column Cleanup of Organic Extracts
OP-013	Shaker Table Extraction
OP-017	Gravimetric Determination
OP-018	Tissue Extraction
OP-021	Organic Waste Dilution
CORPORATE SOP #	**Title**
01-01	Sample Receipt & Login
01-02	Sample Custody and Tracking
01-03	Bottle Order Preparation
05-06	SPLP Extraction Inorganics and Semivolatile Organics, EPA 1312
08-01	Document Control

08-03	Manual Integration
08-05	MDL LOD LOQ
08-07	Control Limit Generation
08-09	Corrective and Preventative Actions
08-12	Demonstration of Capability (DOC) Generation
08-13	Internal Audit Procedure
08-14	Data Review – Organics
08-15	Calculating Measurement Uncertainty
08-16	Annual Management Review
08-17	Sample Compositing Procedure
08-19	Nonconformance Planning/Procedures
09-01	Report Generation and Approval
09-02	Organics Data Deliverable Package Review
10-01	Customer Inquiry and Complaint Procedures
11-01	Computer System Backup/Control
11-02	Computer and Network Security
11-03	Software Validation and Control
13-01	Purchasing Procedure
15-01	Training Program

APPENDIX D

COPIES OF LABORATORY CERTIFICATIONS

State of New Jersey
Department of Environmental Protection

Certifies That

Accutest Laboratories

Laboratory Certification ID # 12129

is hereby approved as a

Nationally Accredited Environmental Laboratory

to perform the analyses as indicated on the Annual Certified Parameter List which must accompany this certificate to be valid

having duly met the requirements of the

Regulations Governing The Certification Of Laboratories And Environmental Measurements N.J.A.C. 7:18 et. seq.

and

having been found compliant with the standards approved by the

The NELAC Institute

Expiration Date June 30, 2011

Joseph F. Aiello, Chief
Office of Quality Assurance

NJDEP is a NELAP Recognized Accreditation Body

This certificate is to be conspicuously displayed at the laboratory with the annual certified parameter list in a location on the premises visible to the public.
Consumers are urged to verify the laboratory's current accreditation status with the State of NJ, NELAP.

R2-0000877

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 02/24/2011 until 06/30/2011

Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: CAP03 – Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CAP03.00180	AE	GC/MS, Canisters	[EPA TO-15]	Acetaldehyde
Certified	Yes	NJ	CAP03.00184	AE	GC/MS, Canisters	[EPA TO-15]	Acetone
Certified	Yes	NJ	CAP03.00190	AE	GC/MS, Canisters	[EPA TO-15]	Acetophenone
Certified	Yes	NJ	CAP03.00195	AE	GC/MS, Canisters	[EPA TO-15]	Acrolein
Certified	Yes	NJ	CAP03.00200	AE	GC/MS, Canisters	[EPA TO-15]	Acrylamide
Certified	Yes	NJ	CAP03.00205	AE	GC/MS, Canisters	[EPA TO-15]	Acrylic acid
Certified	Yes	NJ	CAP03.00215	AE	GC/MS, Canisters	[EPA TO-15]	Allyl chloride
Certified	Yes	NJ	CAP03.00225	AE	GC/MS, Canisters	[EPA TO-15]	Benzene
Certified	Yes	NJ	CAP03.00230	AE	GC/MS, Canisters	[EPA TO-15]	Benzyl chloride
Certified	Yes	NJ	CAP03.00235	AE	GC/MS, Canisters	[EPA TO-15]	Propiolactone (beta-)
Certified	Yes	NJ	CAP03.00240	AE	GC/MS, Canisters	[EPA TO-15]	Bis (2-chloroethyl) ether
Certified	Yes	NJ	CAP03.00245	AE	GC/MS, Canisters	[EPA TO-15]	Bis (chloromethyl) ether
Certified	Yes	NJ	CAP03.00250	AE	GC/MS, Canisters	[EPA TO-15]	Bromodichloromethane
Certified	Yes	NJ	CAP03.00255	AE	GC/MS, Canisters	[EPA TO-15]	Bromoform
Certified	Yes	NJ	CAP03.00260	AE	GC/MS, Canisters	[EPA TO-15]	Bromomethane
Certified	Yes	NJ	CAP03.00265	AE	GC/MS, Canisters	[EPA TO-15]	Butadiene (1,3-)
Certified	Yes	NJ	CAP03.00270	AE	GC/MS, Canisters	[EPA TO-15]	Carbon disulfide
Certified	Yes	NJ	CAP03.00275	AE	GC/MS, Canisters	[EPA TO-15]	Carbon tetrachloride
Certified	Yes	NJ	CAP03.00280	AE	GC/MS, Canisters	[EPA TO-15]	Carbon oxysulfide (Carbonyl sulfide)
Certified	Yes	NJ	CAP03.00285	AE	GC/MS, Canisters	[EPA TO-15]	Catechol
Certified	Yes	NJ	CAP03.00290	AE	GC/MS, Canisters	[EPA TO-15]	Butadiene (2-chloro-1,3-)
Certified	Yes	NJ	CAP03.00295	AE	GC/MS, Canisters	[EPA TO-15]	Chloroacetic acid
Certified	Yes	NJ	CAP03.00300	AE	GC/MS, Canisters	[EPA TO-15]	Chlorobenzene
Certified	Yes	NJ	CAP03.00305	AE	GC/MS, Canisters	[EPA TO-15]	Chloroethane
Certified	Yes	NJ	CAP03.00310	AE	GC/MS, Canisters	[EPA TO-15]	Chloroform
Certified	Yes	NJ	CAP03.00315	AE	GC/MS, Canisters	[EPA TO-15]	Chloromethane
Certified	Yes	NJ	CAP03.00320	AE	GC/MS, Canisters	[EPA TO-15]	Chloromethyl methyl ether
Certified	Yes	NJ	CAP03.00325	AE	GC/MS, Canisters	[EPA TO-15]	Chlorotoluene (2-)
Certified	Yes	NJ	CAP03.00330	AE	GC/MS, Canisters	[EPA TO-15]	Cresols/Cresylic acid
Certified	Yes	NJ	CAP03.00335	AE	GC/MS, Canisters	[EPA TO-15]	Cyclohexane
Certified	Yes	NJ	CAP03.00340	AE	GC/MS, Canisters	[EPA TO-15]	Diazomethane

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 02/24/2011 until 06/30/2011

Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: CAP03 – Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CAP03.00342	AE	GC/MS, Canisters	[EPA TO-15]	Dibromochloromethane
Certified	Yes	NJ	CAP03.00345	AE	GC/MS, Canisters	[EPA TO-15]	Dibromo-3-chloropropane (1,2-)
Certified	Yes	NJ	CAP03.00350	AE	GC/MS, Canisters	[EPA TO-15]	Dibromoethane (1,2-) (EDB)
Certified	Yes	NJ	CAP03.00355	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorobenzene (1,2-)
Certified	Yes	NJ	CAP03.00360	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorobenzene (1,3-)
Certified	Yes	NJ	CAP03.00365	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorobenzene (1,4-)
Certified	Yes	NJ	CAP03.00368	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorodifluoromethane
Certified	Yes	NJ	CAP03.00370	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethane (1,1-)
Certified	Yes	NJ	CAP03.00375	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethane (1,2-)
Certified	Yes	NJ	CAP03.00380	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethene (1,1-)
Certified	Yes	NJ	CAP03.00384	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethene (cis-1,2-)
Certified	Yes	NJ	CAP03.00385	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethene (trans-1,2-)
Certified	Yes	NJ	CAP03.00390	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorofluoromethane
Certified	Yes	NJ	CAP03.00395	AE	GC/MS, Canisters	[EPA TO-15]	Dichloropropane (1,2-)
Certified	Yes	NJ	CAP03.00400	AE	GC/MS, Canisters	[EPA TO-15]	Dichloropropene (cis-1,3-)
Certified	Yes	NJ	CAP03.00401	AE	GC/MS, Canisters	[EPA TO-15]	Dichloropropene (trans-1,3-)
Certified	Yes	NJ	CAP03.00405	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorotetrafluoroethane (1,2-)
Certified	Yes	NJ	CAP03.00410	AE	GC/MS, Canisters	[EPA TO-15]	Diethyl sulfate
Certified	Yes	NJ	CAP03.00415	AE	GC/MS, Canisters	[EPA TO-15]	Dimethyl sulfate
Certified	Yes	NJ	CAP03.00425	AE	GC/MS, Canisters	[EPA TO-15]	Dimethylcarbamoyl chloride
Certified	Yes	NJ	CAP03.00430	AE	GC/MS, Canisters	[EPA TO-15]	Dimethyl formamide (N, N-)
Certified	Yes	NJ	CAP03.00440	AE	GC/MS, Canisters	[EPA TO-15]	Dioxane (1,4-)
Certified	Yes	NJ	CAP03.00445	AE	GC/MS, Canisters	[EPA TO-15]	Epichlorohydrin
Certified	Yes	NJ	CAP03.00450	AE	GC/MS, Canisters	[EPA TO-15]	Epoxybutane (1,2-)
Certified	Yes	NJ	CAP03.00451	AE	GC/MS, Canisters	[EPA TO-15]	Ethanol
Certified	Yes	NJ	CAP03.00452	AE	GC/MS, Canisters	[EPA TO-15]	Ethyl acetate
Certified	Yes	NJ	CAP03.00455	AE	GC/MS, Canisters	[EPA TO-15]	Ethyl acrylate
Certified	Yes	NJ	CAP03.00460	AE	GC/MS, Canisters	[EPA TO-15]	Ethyl carbamate (Urethane)
Certified	Yes	NJ	CAP03.00465	AE	GC/MS, Canisters	[EPA TO-15]	Ethylbenzene
Certified	Yes	NJ	CAP03.00470	AE	GC/MS, Canisters	[EPA TO-15]	Ethylene Oxide
Certified	Yes	NJ	CAP03.00480	AE	GC/MS, Canisters	[EPA TO-15]	Ethyltoluene (4-)
Certified	Yes	NJ	CAP03.00485	AE	GC/MS, Canisters	[EPA TO-15]	Formaldehyde

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Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: CAP03 – Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CAP03.00490	AE	GC/MS, Canisters	[EPA TO-15]	Hexachlorobutadiene (1,3-)
Certified	Yes	NJ	CAP03.00495	AE	GC/MS, Canisters	[EPA TO-15]	Hexachloroethane
Certified	Yes	NJ	CAP03.00498	AE	GC/MS, Canisters	[EPA TO-15]	Hexanone (2-)
Certified	Yes	NJ	CAP03.00500	AE	GC/MS, Canisters	[EPA TO-15]	Heptane (n-)
Certified	Yes	NJ	CAP03.00505	AE	GC/MS, Canisters	[EPA TO-15]	Hexane (n-)
Certified	Yes	NJ	CAP03.00510	AE	GC/MS, Canisters	[EPA TO-15]	Isophorone
Certified	Yes	NJ	CAP03.00511	AE	GC/MS, Canisters	[EPA TO-15]	Isopropanol
Certified	Yes	NJ	CAP03.00515	AE	GC/MS, Canisters	[EPA TO-15]	Isopropylbenzene
Certified	Yes	NJ	CAP03.00520	AE	GC/MS, Canisters	[EPA TO-15]	Methyl alcohol (Methanol)
Certified	Yes	NJ	CAP03.00525	AE	GC/MS, Canisters	[EPA TO-15]	Methyl ethyl ketone
Certified	Yes	NJ	CAP03.00530	AE	GC/MS, Canisters	[EPA TO-15]	Methyl iodide
Certified	Yes	NJ	CAP03.00535	AE	GC/MS, Canisters	[EPA TO-15]	Methyl isobutyl ketone (MIBK)
Certified	Yes	NJ	CAP03.00540	AE	GC/MS, Canisters	[EPA TO-15]	Methyl isocyanate
Certified	Yes	NJ	CAP03.00545	AE	GC/MS, Canisters	[EPA TO-15]	Methyl methacrylate
Certified	Yes	NJ	CAP03.00550	AE	GC/MS, Canisters	[EPA TO-15]	Methyl tert-butyl ether
Certified	Yes	NJ	CAP03.00555	AE	GC/MS, Canisters	[EPA TO-15]	Methylene chloride (Dichloromethane)
Certified	Yes	NJ	CAP03.00565	AE	GC/MS, Canisters	[EPA TO-15]	Methylphenol (2-)
Certified	Yes	NJ	CAP03.00567	AE	GC/MS, Canisters	[EPA TO-15]	Naphthalene
Certified	Yes	NJ	CAP03.00570	AE	GC/MS, Canisters	[EPA TO-15]	Nitrobenzene
Certified	Yes	NJ	CAP03.00575	AE	GC/MS, Canisters	[EPA TO-15]	Nitropropane (2-)
Certified	Yes	NJ	CAP03.00580	AE	GC/MS, Canisters	[EPA TO-15]	N-Nitrosodimethylamine
Certified	Yes	NJ	CAP03.00585	AE	GC/MS, Canisters	[EPA TO-15]	N-Nitrosomorpholine
Certified	Yes	NJ	CAP03.00590	AE	GC/MS, Canisters	[EPA TO-15]	N-Nitroso-N-methylurea
Certified	Yes	NJ	CAP03.00595	AE	GC/MS, Canisters	[EPA TO-15]	Phenol
Certified	Yes	NJ	CAP03.00600	AE	GC/MS, Canisters	[EPA TO-15]	Phosgene
Certified	Yes	NJ	CAP03.00605	AE	GC/MS, Canisters	[EPA TO-15]	Propionaldehyde
Certified	Yes	NJ	CAP03.00612	AE	GC/MS, Canisters	[EPA TO-15]	Propylene
Certified	Yes	NJ	CAP03.00615	AE	GC/MS, Canisters	[EPA TO-15]	Propylene oxide
Certified	Yes	NJ	CAP03.00620	AE	GC/MS, Canisters	[EPA TO-15]	Propane sultone (1,3-)
Certified	Yes	NJ	CAP03.00625	AE	GC/MS, Canisters	[EPA TO-15]	Styrene
Certified	Yes	NJ	CAP03.00630	AE	GC/MS, Canisters	[EPA TO-15]	Styrene oxide
Certified	Yes	NJ	CAP03.00635	AE	GC/MS, Canisters	[EPA TO-15]	Trichlorobenzene (1,2,4-)

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2235 RT 130
BLDG B
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Category: CAP03 -- Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CAP03.00640	AE	GC/MS, Canisters	[EPA TO-15]	Trimethylbenzene (1,3,5-)
Certified	Yes	NJ	CAP03.00645	AE	GC/MS, Canisters	[EPA TO-15]	Trimethylbenzene (1,2,4-)
Certified	Yes	NJ	CAP03.00650	AE	GC/MS, Canisters	[EPA TO-15]	Trimethylpentane (2,2,4-)
Certified	Yes	NJ	CAP03.00652	AE	GC/MS, Canisters	[EPA TO-15]	Tert-butyl alcohol
Certified	Yes	NJ	CAP03.00655	AE	GC/MS, Canisters	[EPA TO-15]	Tetrachloroethane (1,1,2,2-)
Certified	Yes	NJ	CAP03.00660	AE	GC/MS, Canisters	[EPA TO-15]	Tetrachloroethene
Certified	Yes	NJ	CAP03.00662	AE	GC/MS, Canisters	[EPA TO-15]	Tetrahydrofuran
Certified	Yes	NJ	CAP03.00665	AE	GC/MS, Canisters	[EPA TO-15]	Toluene
Certified	Yes	NJ	CAP03.00670	AE	GC/MS, Canisters	[EPA TO-15]	Trichloroethane (1,1,1-)
Certified	Yes	NJ	CAP03.00675	AE	GC/MS, Canisters	[EPA TO-15]	Trichloroethane (1,1,2-)
Certified	Yes	NJ	CAP03.00680	AE	GC/MS, Canisters	[EPA TO-15]	Trichloroethene
Certified	Yes	NJ	CAP03.00684	AE	GC/MS, Canisters	[EPA TO-15]	Trichlorofluoromethane
Certified	Yes	NJ	CAP03.00685	AE	GC/MS, Canisters	[EPA TO-15]	Trichloro (1,1,2-) trifluoroethane (1,2,2-)
Certified	Yes	NJ	CAP03.00695	AE	GC/MS, Canisters	[EPA TO-15]	Trifluoromethane
Certified	Yes	NJ	CAP03.00700	AE	GC/MS, Canisters	[EPA TO-15]	Vinyl acetate
Certified	Yes	NJ	CAP03.00705	AE	GC/MS, Canisters	[EPA TO-15]	Vinyl bromide
Certified	Yes	NJ	CAP03.00710	AE	GC/MS, Canisters	[EPA TO-15]	Vinyl chloride
Certified	Yes	NJ	CAP03.00715	AE	GC/MS, Canisters	[EPA TO-15]	Xylene (m-)
Certified	Yes	NJ	CAP03.00720	AE	GC/MS, Canisters	[EPA TO-15]	Xylene (o-)
Certified	Yes	NJ	CAP03.00725	AE	GC/MS, Canisters	[EPA TO-15]	Xylene (p-)
Certified	Yes	NJ	CAP03.00730	AE	GC/MS, Canisters	[EPA TO-15]	Xylenes (total)
Certified	Yes	NJ	CAP03.02450	AE	GC, FID and/or ECD, Cryogenic Preconcentration	[EPA TO-3]	Benzene
Certified	Yes	NJ	CAP03.02482	AE	GC, FID and/or ECD, Cryogenic Preconcentration	[EPA TO-3]	Ethylbenzene
Certified	Yes	NJ	CAP03.02483	AE	GC, FID and/or ECD, Cryogenic Preconcentration	[EPA TO-3]	Isopropylbenzene
Certified	Yes	NJ	CAP03.02485	AE	GC, FID and/or ECD, Cryogenic Preconcentration	[EPA TO-3]	Methane
Certified	Yes	NJ	CAP03.02486	AE	GC, FID and/or ECD, Cryogenic Preconcentration	[EPA TO-3]	Methyl tert-butyl ether
Certified	Yes	NJ	CAP03.02488	AE	GC, FID and/or ECD, Cryogenic Preconcentration	[EPA TO-3]	Tert-butyl alcohol

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Certified	Yes	NJ	CAP03.02489	AE	GC, FID and/or ECD, Cryogenic Preconcentration	[EPA TO-3]	Toluene
Certified	Yes	NJ	CAP03.02515	AE	GC, FID and/or ECD, Cryogenic Preconcentration	[EPA TO-3]	Xylenes (total)
Applied	No	NJ	CAP03.06850	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Acetone
Applied	No	NJ	CAP03.06852	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Allyl chloride
Applied	No	NJ	CAP03.06854	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Benzene
Applied	No	NJ	CAP03.06856	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Bromodichloromethane
Applied	No	NJ	CAP03.06858	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Bromoform
Applied	No	NJ	CAP03.06860	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Bromomethane
Applied	No	NJ	CAP03.06862	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Butadiene (1,3-)
Applied	No	NJ	CAP03.06864	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Carbon disulfide
Applied	No	NJ	CAP03.06866	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Carbon tetrachloride
Applied	No	NJ	CAP03.06868	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Chlorobenzene
Applied	No	NJ	CAP03.06870	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Chloroethane
Applied	No	NJ	CAP03.06872	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Chloroform
Applied	No	NJ	CAP03.06874	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Chloromethane
Applied	No	NJ	CAP03.06876	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Chlorotoluene (2-)
Applied	No	NJ	CAP03.06878	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Cyclohexane
Applied	No	NJ	CAP03.06880	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dibromochloromethane
Applied	No	NJ	CAP03.06882	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dibromoethane (1,2-) (EDB)
Applied	No	NJ	CAP03.06884	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichlorobenzene (1,2-)
Applied	No	NJ	CAP03.06886	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichlorobenzene (1,3-)
Applied	No	NJ	CAP03.06888	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichlorobenzene (1,4-)
Applied	No	NJ	CAP03.06890	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichlorodifluoromethane
Applied	No	NJ	CAP03.06892	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichloroethane (1,1-)
Applied	No	NJ	CAP03.06894	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichloroethane (1,2-)
Applied	No	NJ	CAP03.06896	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichloroethene (1,1-)
Applied	No	NJ	CAP03.06898	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichloroethene (cis-1,2-)
Applied	No	NJ	CAP03.06900	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichloroethene (trans-1,2-)
Applied	No	NJ	CAP03.06902	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichloropropane (1,2-)
Applied	No	NJ	CAP03.06904	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichloropropene (cis-1,3-)

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2235 RT 130
BLDG B
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Applied	No	NJ	CAP03.06906	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichloropropene (trans-1,3-)
Applied	No	NJ	CAP03.06908	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dichlorotetrafluoroethane (1,2-)
Applied	No	NJ	CAP03.06910	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Dioxane (1,4-)
Applied	No	NJ	CAP03.06912	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Ethanol
Applied	No	NJ	CAP03.06914	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Ethylbenzene
Applied	No	NJ	CAP03.06916	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Ethyltoluene (4-)
Applied	No	NJ	CAP03.06918	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Heptane (n-)
Applied	No	NJ	CAP03.06920	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Hexachlorobutadiene (1,3-)
Applied	No	NJ	CAP03.06922	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Hexane (n-)
Applied	No	NJ	CAP03.06924	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Isopropanol
Applied	No	NJ	CAP03.06926	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Methylene chloride (Dichloromethane)
Applied	No	NJ	CAP03.06928	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Methyl ethyl ketone
Applied	No	NJ	CAP03.06930	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Methyl isobutyl ketone (MIBK)
Applied	No	NJ	CAP03.06932	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Methyl methacrylate
Applied	No	NJ	CAP03.06934	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Methyl tert-butyl ether
Applied	No	NJ	CAP03.06936	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Styrene
Applied	No	NJ	CAP03.06938	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Tert-butyl alcohol
Applied	No	NJ	CAP03.06940	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Tetrachloroethane (1,1,2,2-)
Applied	No	NJ	CAP03.06942	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Tetrachloroethene
Applied	No	NJ	CAP03.06944	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Tetrahydrofuran
Applied	No	NJ	CAP03.06946	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Toluene
Applied	No	NJ	CAP03.06948	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Trichlorobenzene (1,2,4-)
Applied	No	NJ	CAP03.06950	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Trichloroethane (1,1,1-)
Applied	No	NJ	CAP03.06952	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Trichloroethane (1,1,2-)
Applied	No	NJ	CAP03.06954	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Trichloroethene
Applied	No	NJ	CAP03.06956	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Trichlorofluoromethane
Applied	No	NJ	CAP03.06958	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Trichloro (1,1,2-) trifluoroethane (1,2,2-)
Applied	No	NJ	CAP03.06960	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Trimethylbenzene (1,2,4-)
Applied	No	NJ	CAP03.06962	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Trimethylbenzene (1,3,5-)
Applied	No	NJ	CAP03.06964	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Trimethylpentane (2,2,4-)
Applied	No	NJ	CAP03.06966	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Vinyl bromide
Applied	No	NJ	CAP03.06968	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Vinyl chloride

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Applied	No	NJ	CAP03.06970	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3:2007]	Xylene (m- + p-)
Applied	No	NJ	CAP03.06972	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2007]	Xylene (o-)

Category: SDW01 – Microbiological Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SDW01.05000	DW	ONPG-MUG (Autoanalysis Colilert System) (P-A)	[SM 9223B]	Total coliform / E. coli
Certified	Yes	NJ	SDW01.14000	DW	Pour Plate	[SM 9215 B]	Heterotrophic bacteria

Category: SDW02 – Inorganic Parameters Including Na + Ca

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SDW02.01000	DW	Nephelometric	[EPA 180.1]	Turbidity
Certified	Yes	NJ	SDW02.02000	DW	Automated Cadmium Reduction	[EPA 353.2]	Nitrate
Certified	Yes	NJ	SDW02.09000	DW	Spectrophotometric	[SM 4500-NO2 B]	Nitrite
Certified	Yes	NJ	SDW02.14000	DW	Ion Chromatography	[EPA 300.0]	Fluoride
Certified	Yes	NJ	SDW02.15200	DW	Spectrophotometric, Distill, Semi Automated	[EPA 335.4]	Cyanide
Certified	Yes	NJ	SDW02.19000	DW	Ion Chromatography	[EPA 300.0]	Sulfate
Certified	Yes	NJ	SDW02.20000	DW	ICP	[EPA 200.7]	Sodium
Certified	Yes	NJ	SDW02.24000	DW	Gravimetric At 180	[SM 2540 C]	Total dissolved solids (TDS)
Certified	Yes	NJ	SDW02.27000	DW	ICP	[EPA 200.7]	Calcium
Certified	Yes	NJ	SDW02.27200	DW	Ca as Carbonate	[EPA 200.7]	Calcium-hardness
Certified	Yes	NJ	SDW02.27300	DW	Hardness By Calculation	[EPA 200.7]	Total hardness
Certified	Yes	NJ	SDW02.27400	DW	Titrimetric, EDTA	[SM 2340 C]	Total hardness
Certified	Yes	NJ	SDW02.29000	DW	Electrometric Titration	[SM 2320 B]	Alkalinity
Certified	Yes	NJ	SDW02.29310	DW	Automated Phenate	[SM 4500-NH3 G]	Ammonia
Certified	Yes	NJ	SDW02.31000	DW	Ion Chromatography	[EPA 300.0]	Chloride
Certified	Yes	NJ	SDW02.31120	DW	Ion Chromatography	[EPA 314.0]	Perchlorate
Certified	Yes	NJ	SDW02.32000	DW	Platinum-Cobalt	[SM 2120 B]	Color

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Category: SDW02 -- Inorganic Parameters Including Na + Ca

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SDW02.33000	DW	Methylene Blue	[SM 5540 C]	Foaming agents
Certified	Yes	NJ	SDW02.34000	DW	Consistent Series	[SM 2150 B]	Odor
Certified	Yes	NJ	SDW02.35000	DW	Conductance	[SM 2510 B]	Conductivity
Certified	Yes	NJ	SDW02.36100	DW	Molybdosilicate	[SM 4500-Si D (18/19th ed)]	Silica
Certified	Yes	NJ	SDW02.36400	DW	ICP	[EPA 200.7]	Silica
Certified	Yes	NJ	SDW02.37000	DW	Colorimetric	[SM 4500-P E]	Orthophosphate
Certified	Yes	NJ	SDW02.39600	DW	High Temp. Combustion	[SM 5310 B]	Total organic carbon (TOC)
Certified	Yes	NJ	SDW02.40000	DW	Pyrolysis, Titrimetric	[SM 5320 B]	Total organic halides (TOX)

Category: SDW03 -- Analyze-Immediately Inorganic Parameter

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SDW03.00002	DW	All Categories Sample Handling Procedures	[OTHER NJAC 7:18-6 & 9]	PWTA Sampling Parameters
Certified	Yes	NJ	SDW03.02000	DW	DPD, Ferrous Titrimetric	[SM 4500-Cl F]	Chlorine - residual
Certified	Yes	NJ	SDW03.08000	DW	Electrometric	[SM 4500-H B]	pH
Certified	Yes	NJ	SDW03.09000	DW	Thermometric	[SM 2550 B]	Temperature

Category: SDW04 -- Inorganic Parameters, Metals

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SDW04.03000	DW	ICP	[EPA 200.7]	Aluminum
Certified	Yes	NJ	SDW04.03100	DW	ICP/MS	[EPA 200.8]	Aluminum
Certified	Yes	NJ	SDW04.07000	DW	ICP/MS	[EPA 200.8]	Antimony
Certified	Yes	NJ	SDW04.12000	DW	ICP/MS	[EPA 200.8]	Arsenic
Certified	Yes	NJ	SDW04.16000	DW	ICP	[EPA 200.7]	Barium
Certified	Yes	NJ	SDW04.17000	DW	ICP/MS	[EPA 200.8]	Barium
Certified	Yes	NJ	SDW04.20000	DW	ICP	[EPA 200.7]	Beryllium
Certified	Yes	NJ	SDW04.21000	DW	ICP/MS	[EPA 200.8]	Beryllium
Certified	Yes	NJ	SDW04.24000	DW	ICP	[EPA 200.7]	Cadmium

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Effective as of 02/24/2011 until 06/30/2011

Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: SDW04 – Inorganic Parameters, Metals

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SDW04.25000	DW	ICP/MS	[EPA 200.8]	Cadmium
Certified	Yes	NJ	SDW04.28000	DW	ICP	[EPA 200.7]	Chromium
Certified	Yes	NJ	SDW04.29000	DW	ICP/MS	[EPA 200.8]	Chromium
Certified	Yes	NJ	SDW04.33000	DW	ICP	[EPA 200.7]	Copper
Certified	Yes	NJ	SDW04.34000	DW	ICP/MS	[EPA 200.8]	Copper
Certified	Yes	NJ	SDW04.37000	DW	ICP	[EPA 200.7]	Iron
Certified	Yes	NJ	SDW04.40000	DW	ICP/MS	[EPA 200.8]	Lead
Certified	Yes	NJ	SDW04.41100	DW	ICP	[EPA 200.7]	Magnesium
Certified	Yes	NJ	SDW04.44000	DW	ICP	[EPA 200.7]	Manganese
Certified	Yes	NJ	SDW04.45000	DW	ICP/MS	[EPA 200.8]	Manganese
Certified	Yes	NJ	SDW04.46000	DW	Manual Cold Vapor	[EPA 245.1]	Mercury
Certified	Yes	NJ	SDW04.52000	DW	ICP	[EPA 200.7]	Nickel
Certified	Yes	NJ	SDW04.53000	DW	ICP/MS	[EPA 200.8]	Nickel
Certified	Yes	NJ	SDW04.57000	DW	ICP/MS	[EPA 200.8]	Selenium
Certified	Yes	NJ	SDW04.62000	DW	ICP	[EPA 200.7]	Silver
Certified	Yes	NJ	SDW04.63000	DW	ICP/MS	[EPA 200.8]	Silver
Certified	Yes	NJ	SDW04.65000	DW	ICP/MS	[EPA 200.8]	Thallium
Certified	Yes	NJ	SDW04.67000	DW	ICP	[EPA 200.7]	Zinc
Certified	Yes	NJ	SDW04.68000	DW	ICP/MS	[EPA 200.8]	Zinc

Category: SDW05 – Organic Parameters, Chromatography

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SDW05.12010	DW	Solvent Extract, GC	[EPA 504.1]	Dibromoethane (1,2-) (EDB)
Certified	Yes	NJ	SDW05.12020	DW	Solvent Extract, GC	[EPA 504.1]	Dibromo-3-chloropropane (1,2-)
Certified	Yes	NJ	SDW05.12030	DW	Solvent Extract, GC	[EPA 504.1]	Trichloropropane (1,2,3-)

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Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: SDW06 – Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SDW06.01010	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Bromoform
Certified	Yes	NJ	SDW06.01020	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Chloroform
Certified	Yes	NJ	SDW06.01030	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dibromochloromethane
Certified	Yes	NJ	SDW06.01040	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Bromodichloromethane
Certified	Yes	NJ	SDW06.02010	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Benzene
Certified	Yes	NJ	SDW06.02020	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Carbon tetrachloride
Certified	Yes	NJ	SDW06.02030	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Chlorobenzene
Certified	Yes	NJ	SDW06.02040	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichlorobenzene (1,2-)
Certified	Yes	NJ	SDW06.02050	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichlorobenzene (1,3-)
Certified	Yes	NJ	SDW06.02060	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichlorobenzene (1,4-)
Certified	Yes	NJ	SDW06.02070	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloroethane (1,1-)
Certified	Yes	NJ	SDW06.02080	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloroethane (1,2-)
Certified	Yes	NJ	SDW06.02090	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloroethene (cis-1,2-)
Certified	Yes	NJ	SDW06.02100	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloroethene (trans-1,2-)
Certified	Yes	NJ	SDW06.02110	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Methylene chloride (Dichloromethane)
Certified	Yes	NJ	SDW06.02120	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloropropane (1,2-)
Certified	Yes	NJ	SDW06.02130	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Ethylbenzene
Certified	Yes	NJ	SDW06.02140	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Methyl tert-butyl ether
Certified	Yes	NJ	SDW06.02150	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Naphthalene
Certified	Yes	NJ	SDW06.02160	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Styrene
Certified	Yes	NJ	SDW06.02170	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Tetrachloroethane (1,1,2,2-)
Certified	Yes	NJ	SDW06.02180	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Tetrachloroethene
Certified	Yes	NJ	SDW06.02190	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Trichloroethane (1,1,1-)
Certified	Yes	NJ	SDW06.02200	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Trichloroethene
Certified	Yes	NJ	SDW06.02210	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Toluene
Certified	Yes	NJ	SDW06.02220	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Trichlorobenzene (1,2,4-)
Certified	Yes	NJ	SDW06.02230	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloroethene (1,1-)
Certified	Yes	NJ	SDW06.02240	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Trichloroethane (1,1,2-)
Certified	Yes	NJ	SDW06.02250	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Vinyl chloride
Certified	Yes	NJ	SDW06.02260	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Xylenes (total)
Certified	Yes	NJ	SDW06.03010	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Bromobenzene
Certified	Yes	NJ	SDW06.03020	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Bromochloromethane

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Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: SDW06 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SDW06.03030	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Bromomethane
Certified	Yes	NJ	SDW06.03040	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Butyl benzene (n-)
Certified	Yes	NJ	SDW06.03050	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Sec-butylbenzene
Certified	Yes	NJ	SDW06.03060	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Tert-butylbenzene
Certified	Yes	NJ	SDW06.03070	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Chloroethane
Certified	Yes	NJ	SDW06.03080	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Chloromethane
Certified	Yes	NJ	SDW06.03090	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Chlorotoluene (2-)
Certified	Yes	NJ	SDW06.03100	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Chlorotoluene (4-)
Certified	Yes	NJ	SDW06.03110	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dibromo-3-chloropropane (1,2-)
Certified	Yes	NJ	SDW06.03120	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dibromoethane (1,2-) (EDB)
Certified	Yes	NJ	SDW06.03130	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dibromomethane
Certified	Yes	NJ	SDW06.03140	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichlorodifluoromethane
Certified	Yes	NJ	SDW06.03150	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloropropane (1,3-)
Certified	Yes	NJ	SDW06.03160	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloropropane (2,2-)
Certified	Yes	NJ	SDW06.03170	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloropropene (1,1-)
Certified	Yes	NJ	SDW06.03180	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloropropene (cis-1,3-)
Certified	Yes	NJ	SDW06.03190	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloropropene (trans-1,3-)
Certified	Yes	NJ	SDW06.03200	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Hexachlorobutadiene (1,3-)
Certified	Yes	NJ	SDW06.03210	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Isopropylbenzene
Certified	Yes	NJ	SDW06.03220	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Isopropyltoluene (4-)
Certified	Yes	NJ	SDW06.03230	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Propylbenzene (n-)
Certified	Yes	NJ	SDW06.03240	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Tetrachloroethane (1,1,1,2-)
Certified	Yes	NJ	SDW06.03250	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Trichlorobenzene (1,2,3-)
Certified	Yes	NJ	SDW06.03260	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Trichlorofluoromethane
Certified	Yes	NJ	SDW06.03270	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Trichloropropane (1,2,3-)
Certified	Yes	NJ	SDW06.03280	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Trimethylbenzene (1,2,4-)
Certified	Yes	NJ	SDW06.03300	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Trimethylbenzene (1,3,5-)
Certified	Yes	NJ	SDW06.03310	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Nitrobenzene
Certified	Yes	NJ	SDW06.03410	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Acetone
Certified	Yes	NJ	SDW06.03420	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Acrylonitrile
Certified	Yes	NJ	SDW06.03430	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Allyl chloride
Certified	Yes	NJ	SDW06.03440	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Butanone (2-)

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Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: SDW06 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SDW06.03450	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Carbon disulfide
Certified	Yes	NJ	SDW06.03460	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Chloroacetonitrile
Certified	Yes	NJ	SDW06.03470	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Chlorobutane (1-)
Certified	Yes	NJ	SDW06.03480	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloro-2-butene (trans-1,4-)
Certified	Yes	NJ	SDW06.03490	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Dichloropropanone (1,1-)
Certified	Yes	NJ	SDW06.03500	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Diethyl ether (Ethyl ether)
Certified	Yes	NJ	SDW06.03510	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Ethyl methacrylate
Applied	No	NJ	SDW06.03515	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Hexane (n-)
Certified	Yes	NJ	SDW06.03520	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Hexachloroethane
Certified	Yes	NJ	SDW06.03530	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Hexanone (2-)
Certified	Yes	NJ	SDW06.03540	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Methacrylonitrile
Certified	Yes	NJ	SDW06.03550	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Methyl acrylate
Certified	Yes	NJ	SDW06.03560	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Methyl iodide
Certified	Yes	NJ	SDW06.03570	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Methyl methacrylate
Certified	Yes	NJ	SDW06.03580	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Pentanone (4-methyl-2-) (MIBK)
Certified	Yes	NJ	SDW06.03590	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Nitropropane (2-)
Certified	Yes	NJ	SDW06.03600	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Pentachloroethane
Certified	Yes	NJ	SDW06.03610	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Propionitrile
Certified	Yes	NJ	SDW06.03615	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Tert-butyl alcohol
Certified	Yes	NJ	SDW06.03620	DW	GC/MS, P & T or Direct Injection, Capillary	[EPA 524.2]	Tetrahydrofuran

Category: SHW03 -- Analyze-Immediately Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW03.02000	NPW	Thermometric	[SM 2550 B]	Temperature

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2235 RT 130
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Category: SHW04 -- Inorganic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW04.01000	NPW	Acid Digestion/Surface and Groundwater, ICP, FLAA	[SW-846 3005A]	Metals, Total Rec and Dissolved
Certified	Yes	NJ	SHW04.01500	NPW	Acid Digestion/Aqueous Samples, ICP, FLAA	[SW-846 3010A]	Metals, Total
Certified	Yes	NJ	SHW04.33000	NPW	AA, Manual Cold Vapor	[SW-846 7470A]	Mercury - liquid waste

Category: SHW05 -- Organic Parameters, Prep. / Screening

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW05.01000	NPW	Separatory Funnel Extraction	[SW-846 3510C]	Semivolatile organics
Certified	Yes	NJ	SHW05.02000	NPW	Continuous Liquid-Liquid Extraction	[SW-846 3520C]	Semivolatile organics
Certified	Yes	NJ	SHW05.07000	NPW	Purge & Trap Aqueous	[SW-846 5030B]	Volatile organics

Category: SHW07 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW07.04016	NPW	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Benzyl chloride
Certified	Yes	NJ	SHW07.04680	NPW	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Aramite
Certified	Yes	NJ	SHW07.04775	NPW	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Dimethyl benzidine (3,3-)
Certified	Yes	NJ	SHW07.04795	NPW	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Famphur
Certified	Yes	NJ	SHW07.04800	NPW	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Hexachlorophene
Certified	Yes	NJ	SHW07.04840	NPW	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Methapyrilene
Certified	Yes	NJ	SHW07.04915	NPW	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Phenylenediamine (1,4-)

Category: SHW09 -- Miscellaneous Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW09.06000	NPW	Combustion, Titration	[SW-846 9020B, Rev. 2, 9/94]	Total organic halides (TOX)
Certified	Yes	NJ	SHW09.17000	NPW	Wheatstone Bridge	[SW-846 9050A, Rev. 1, 12/96]	Specific conductance

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2235 RT 130
BLDG B
Dayton, NJ 08810

Category: SHW09 -- Miscellaneous Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW09.22000	NPW	Colorimetric, Auto, 4AAP Distillation	[SW-846 9066, Rev. 0, 9/86]	Phenols

Category: WPP01 -- Microbiological Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	WPP01.02000	NPW	Membrane Filter (MF), Single Step	[SM 9222 D]	Fecal coliform
Certified	Yes	NJ	WPP01.04000	NPW	MF Single Step or Two Step	[SM 9222 B]	Total coliform
Certified	Yes	NJ	WPP01.10000	NPW	Pour Plate	[SM 9215 B]	Heterotrophic plate count

Category: WPP02 -- Inorg. Parameters, Nutrients and Demands

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	WPP02.01000	NPW	Electrometric or Phenolphthalein	[SM 2310 B(4A)]	Acidity as CaCO3
Certified	Yes	NJ	WPP02.01500	NPW	Electrometric or Color Titration	[SM 2320 B]	Alkalinity as CaCO3
Certified	Yes	NJ	WPP02.04000	NPW	Automated Phenate	[SM 4500-NH3 B+G (20th ed.)]	Ammonia
Certified	Yes	NJ	WPP02.05000	NPW	Dissolved Oxygen Depletion	[SM 5210 B]	Biochemical oxygen demand
Certified	Yes	NJ	WPP02.06000	NPW	ICP	[EPA 200.7]	Boron
Certified	Yes	NJ	WPP02.07100	NPW	Ion Chromatography	[EPA 300.0]	Bromide
Certified	Yes	NJ	WPP02.08000	NPW	Digestion, ICP	[EPA 200.7]	Calcium
Certified	Yes	NJ	WPP02.08050	NPW	ICP/MS	[EPA 200.8]	Calcium
Certified	Yes	NJ	WPP02.09500	NPW	Dissolved Oxygen Depletion, Nitrification Inhibition	[SM 5210 B]	Carbonaceous BOD (CBOD)
Certified	Yes	NJ	WPP02.10000	NPW	Titrimetric	[SM 5220 C]	Chemical oxygen demand
Certified	Yes	NJ	WPP02.11500	NPW	Titrimetric, Mercuric Nitrate	[SM 4500-Cl C]	Chloride
Certified	Yes	NJ	WPP02.12600	NPW	Ion Chromatography	[EPA 300.0]	Chloride
Certified	Yes	NJ	WPP02.13500	NPW	Colorimetric (Platinum-Cobalt)	[SM 2120 B]	Color
Certified	Yes	NJ	WPP02.15500	NPW	Distillation, Spectrophotometric (Auto)	[EPA 335.4]	Cyanide
Certified	Yes	NJ	WPP02.16000	NPW	Manual Distillation, Titrimetr/Spectro	[SM 4500-CN C,G]	Cyanide - amenable to Cl2
Certified	Yes	NJ	WPP02.18100	NPW	Ion Chromatography	[EPA 300.0]	Fluoride
Certified	Yes	NJ	WPP02.19000	NPW	Titrimetric, EDTA	[SM 2340 B or C]	Hardness - total as CaCO3

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New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 02/24/2011 until 06/30/2011

Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: WPP02 – Inorg. Parameters, Nutrients and Demands

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	WPP02.20100	NPW	Ca + Mg Carbonates, ICP	[EPA 200.7]	Hardness - total as CaCO3
Certified	Yes	NJ	WPP02.22500	NPW	Digestion, Distillation, Semiautomated Digestor	[EPA 351.2]	Kjeldahl nitrogen - total
Certified	Yes	NJ	WPP02.24000	NPW	Digestion, ICP	[EPA 200.7]	Magnesium
Certified	Yes	NJ	WPP02.24050	NPW	ICP/MS	[EPA 200.8]	Magnesium
Certified	Yes	NJ	WPP02.27000	NPW	Cadmium Reduction, Automated	[EPA 353.2]	Nitrate - nitrite
Certified	Yes	NJ	WPP02.28000	NPW	Spectrophotometric, Manual	[SM 4500-NO2 B]	Nitrite
Certified	Yes	NJ	WPP02.29100	NPW	Gravimetric, Hexane Extractable Material-LL	[EPA 1664A]	Oil & grease - hem-LL
Certified	Yes	NJ	WPP02.29200	NPW	Gravimetric, Silica Gel Treated-Hem	[EPA 1664A]	Oil & grease - sgt-non polar
Certified	Yes	NJ	WPP02.30000	NPW	Combustion or Oxidation	[SM 5310 B, C or D]	Total organic carbon (TOC)
Certified	Yes	NJ	WPP02.30500	NPW	Total Kjeldahl-N Minus Ammonia-N	[USER DEFINED EPA 351.2 - SM4500 NH3 B+G (20TH ED)]	Organic nitrogen
Certified	Yes	NJ	WPP02.31500	NPW	Ascorbic Acid, Manual Single Reagent	[SM 4500-P, E]	Orthophosphate
Certified	Yes	NJ	WPP02.33000	NPW	Manual Distillation, Colorimetric Auto	[EPA 420.1 + .4]	Phenols
Certified	Yes	NJ	WPP02.34000	NPW	Persulfate Digestion + Manual	[EPA 365.3]	Phosphorus (total)
Certified	Yes	NJ	WPP02.36500	NPW	Digestion, ICP	[EPA 200.7]	Potassium
Certified	Yes	NJ	WPP02.36550	NPW	ICP/MS	[EPA 200.8]	Potassium
Certified	Yes	NJ	WPP02.38000	NPW	Gravimetric, 103-105 Degrees C	[SM 2540 B]	Residue - total
Certified	Yes	NJ	WPP02.38500	NPW	Gravimetric, 180 Degrees C	[SM 2540 C]	Residue - filterable (TDS)
Certified	Yes	NJ	WPP02.39000	NPW	Gravimetric, 103-105 Degrees C, Post Washing	[SM 2540 D]	Residue - nonfilterable (TSS)
Certified	Yes	NJ	WPP02.39500	NPW	Volumetric (Imhoff Cone) or Gravimetric	[SM 2540 F]	Residue - settleable
Certified	Yes	NJ	WPP02.40000	NPW	Gravimetric, 550 Degrees C	[EPA 160.4]	Residue - volatile
Certified	Yes	NJ	WPP02.40100	NPW	Gravimetric, 500 Degrees C	[SM 2540 G SM 18th Ed.]	Total, fixed, and volatile solids (SQAR)
Certified	Yes	NJ	WPP02.40500	NPW	Electrical Conductivity	[SM 2520 B]	Salinity
Certified	Yes	NJ	WPP02.41500	NPW	0.45u Filtration + Colorimetric (Manual)	[SM 4500-Si D (18/19th ed)]	Silica - dissolved
Certified	Yes	NJ	WPP02.42500	NPW	0.45u Filtration + ICP	[EPA 200.7]	Silica - dissolved
Certified	Yes	NJ	WPP02.44000	NPW	Digestion, ICP	[EPA 200.7]	Sodium
Certified	Yes	NJ	WPP02.44050	NPW	ICP/MS	[EPA 200.8]	Sodium
Certified	Yes	NJ	WPP02.45500	NPW	Wheatstone Bridge	[SM 2510 B]	Specific conductance
Certified	Yes	NJ	WPP02.47100	NPW	Ion Chromatography	[EPA 300.0]	Sulfate
Certified	Yes	NJ	WPP02.47500	NPW	Titrimetric, Iodine	[SM 4500-S F (19/20th ed)]	Sulfides
Certified	Yes	NJ	WPP02.48500	NPW	Colorimetric (Methylene Blue)	[SM 5540 C]	Surfactants
Certified	Yes	NJ	WPP02.48510	NPW	Colorimetric (CTAS)	[SM 5540 D]	Surfactants

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Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: WPP02 -- Inorg. Parameters, Nutrients and Demands

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	WPP02.50000	NPW	Nephelometric	[EPA 180.1]	Turbidity

Category: WPP03 -- Analyze-Immediately Inorganic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	WPP03.04000	NPW	DPD-FAS	[SM 4500-Cl F]	Chlorine
Certified	Yes	NJ	WPP03.07000	NPW	Winkler, Azide Modification	[SM 4500-O C]	Oxygen (dissolved)
Certified	Yes	NJ	WPP03.08000	NPW	Electrode	[SM 4500-O G]	Oxygen (dissolved)
Certified	Yes	NJ	WPP03.09000	NPW	Electrometric	[SM 4500-H B]	pH
Certified	Yes	NJ	WPP03.12000	NPW	Titrimetric, Iodine-Iodate	[SM 4500-SO3 B]	Sulfite - SO3
Certified	Yes	NJ	WPP03.14000	NPW	Thermometric	[SM 2550 B]	Temperature

Category: WPP04 -- Inorganic Parameters, Metals

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	WPP04.02000	NPW	Digestion, ICP	[EPA 200.7]	Aluminum
Certified	Yes	NJ	WPP04.02100	NPW	ICP/MS	[EPA 200.8]	Aluminum
Certified	Yes	NJ	WPP04.04500	NPW	Digestion, ICP	[EPA 200.7]	Antimony
Certified	Yes	NJ	WPP04.04600	NPW	ICP/MS	[EPA 200.8]	Antimony
Certified	Yes	NJ	WPP04.05600	NPW	Digestion, ICP	[EPA 200.7]	Arsenic
Certified	Yes	NJ	WPP04.05700	NPW	ICP/MS	[EPA 200.8]	Arsenic
Certified	Yes	NJ	WPP04.08000	NPW	Digestion, ICP	[EPA 200.7]	Barium
Certified	Yes	NJ	WPP04.08200	NPW	ICP/MS	[EPA 200.8]	Barium
Certified	Yes	NJ	WPP04.11000	NPW	Digestion, ICP	[EPA 200.7]	Beryllium
Certified	Yes	NJ	WPP04.11100	NPW	ICP/MS	[EPA 200.8]	Beryllium
Certified	Yes	NJ	WPP04.13500	NPW	Digestion, ICP	[EPA 200.7]	Cadmium
Certified	Yes	NJ	WPP04.13600	NPW	ICP/MS	[EPA 200.8]	Cadmium
Certified	Yes	NJ	WPP04.15000	NPW	0.45u Filter, Colorimetric DPC	[SM 3500-Cr D (18/19th ed)]	Chromium (VI)
Certified	Yes	NJ	WPP04.15100	NPW	0.45u Filter, Ion Chromatography	[EPA 218.6]	Chromium (VI)

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2235 RT 130
BLDG B
Dayton, NJ 08810

Category: WPP04 -- Inorganic Parameters, Metals

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	WPP04.18000	NPW	Digestion, ICP	[EPA 200.7]	Chromium
Certified	Yes	NJ	WPP04.18100	NPW	ICP/MS	[EPA 200.8]	Chromium
Certified	Yes	NJ	WPP04.19500	NPW	Digestion, ICP	[EPA 200.7]	Cobalt
Certified	Yes	NJ	WPP04.19600	NPW	ICP/MS	[EPA 200.8]	Cobalt
Certified	Yes	NJ	WPP04.21500	NPW	Digestion, ICP	[EPA 200.7]	Copper
Certified	Yes	NJ	WPP04.21600	NPW	ICP/MS	[EPA 200.8]	Copper
Certified	Yes	NJ	WPP04.26500	NPW	Digestion, ICP	[EPA 200.7]	Iron
Certified	Yes	NJ	WPP04.26550	NPW	ICP/MS	[EPA 200.8]	Iron
Certified	Yes	NJ	WPP04.27001	NPW	Digestion, Colorimetric (Phenanthroline)	[SM 3500-Fe B (20th ed)]	Iron, Ferrous
Certified	Yes	NJ	WPP04.28000	NPW	Digestion, ICP	[EPA 200.7]	Lead
Certified	Yes	NJ	WPP04.28100	NPW	ICP/MS	[EPA 200.8]	Lead
Certified	Yes	NJ	WPP04.31000	NPW	Digestion, ICP	[EPA 200.7]	Manganese
Certified	Yes	NJ	WPP04.31100	NPW	ICP/MS	[EPA 200.8]	Manganese
Certified	Yes	NJ	WPP04.33000	NPW	Manual Cold Vapor	[EPA 245.1]	Mercury
Certified	Yes	NJ	WPP04.33100	NPW	Cold Vapor Atomic Fluorescence Spectrometry	[EPA 245.7]	Mercury
Certified	Yes	NJ	WPP04.33200	NPW	Purge & Trap Atomic Fluorescence	[EPA 1631E]	Mercury
Certified	Yes	NJ	WPP04.35000	NPW	Digestion, ICP	[EPA 200.7]	Molybdenum
Certified	Yes	NJ	WPP04.35200	NPW	ICP/MS	[EPA 200.8]	Molybdenum
Certified	Yes	NJ	WPP04.37500	NPW	Digestion, ICP	[EPA 200.7]	Nickel
Certified	Yes	NJ	WPP04.37600	NPW	ICP/MS	[EPA 200.8]	Nickel
Certified	Yes	NJ	WPP04.45500	NPW	Digestion, ICP	[EPA 200.7]	Selenium
Certified	Yes	NJ	WPP04.45600	NPW	ICP/MS	[EPA 200.8]	Selenium
Certified	Yes	NJ	WPP04.48000	NPW	Digestion, ICP	[EPA 200.7]	Silver
Certified	Yes	NJ	WPP04.48200	NPW	ICP/MS	[EPA 200.8]	Silver
Certified	Yes	NJ	WPP04.50000	NPW	Digestion, ICP	[EPA 200.7]	Thallium
Certified	Yes	NJ	WPP04.50100	NPW	ICP/MS	[EPA 200.8]	Thallium
Certified	Yes	NJ	WPP04.51100	NPW	Digestion, ICP	[EPA 200.7]	Tin
Certified	Yes	NJ	WPP04.51200	NPW	ICP/MS	[EPA 200.8]	Tin
Certified	Yes	NJ	WPP04.52050	NPW	Digestion, ICP	[EPA 200.7]	Titanium
Certified	Yes	NJ	WPP04.52070	NPW	ICP/MS	[EPA 200.8]	Titanium
Certified	Yes	NJ	WPP04.54000	NPW	Digestion, ICP	[EPA 200.7]	Vanadium
Certified	Yes	NJ	WPP04.54100	NPW	ICP/MS	[EPA 200.8]	Vanadium

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Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: WPP04 – Inorganic Parameters, Metals

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	WPP04.56500	NPW	Digestion, ICP	[EPA 200.7]	Zinc
Certified	Yes	NJ	WPP04.56600	NPW	ICP/MS	[EPA 200.8]	Zinc

Category: WPP05 – Organic Parameters, Chromatography

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	WPP05.02010	NPW	Purge & Trap, GC (PID)	[EPA 602]	Benzene
Certified	Yes	NJ	WPP05.02020	NPW	Purge & Trap, GC (PID)	[EPA 602]	Chlorobenzene
Certified	Yes	NJ	WPP05.02030	NPW	Purge & Trap, GC (PID)	[EPA 602]	Dichlorobenzene (1,2-)
Certified	Yes	NJ	WPP05.02040	NPW	Purge & Trap, GC (PID)	[EPA 602]	Dichlorobenzene (1,3-)
Certified	Yes	NJ	WPP05.02050	NPW	Purge & Trap, GC (PID)	[EPA 602]	Dichlorobenzene (1,4-)
Certified	Yes	NJ	WPP05.02060	NPW	Purge & Trap, GC (PID)	[EPA 602]	Ethylbenzene
Certified	Yes	NJ	WPP05.02062	NPW	Purge & Trap, GC (PID)	[EPA 602]	Methyl tert-butyl ether
Certified	Yes	NJ	WPP05.02064	NPW	Purge & Trap, GC (PID)	[EPA 602]	Tert-butyl alcohol
Certified	Yes	NJ	WPP05.02070	NPW	Purge & Trap, GC (PID)	[EPA 602]	Toluene
Certified	Yes	NJ	WPP05.02080	NPW	Purge & Trap, GC (PID)	[EPA 602]	Xylenes (total)
Certified	Yes	NJ	WPP05.03000	NPW	Purge & Trap, GC (FID)	[EPA 603]	Acrolein
Certified	Yes	NJ	WPP05.03005	NPW	Purge & Trap, GC (FID)	[EPA 603]	Acrylonitrile
Certified	Yes	NJ	WPP05.09010	NPW	Extract/GC (ECD)	[EPA 608]	Aldrin
Certified	Yes	NJ	WPP05.09020	NPW	Extract/GC (ECD)	[EPA 608]	Alpha BHC
Certified	Yes	NJ	WPP05.09030	NPW	Extract/GC (ECD)	[EPA 608]	Beta BHC
Certified	Yes	NJ	WPP05.09040	NPW	Extract/GC (ECD)	[EPA 608]	Delta BHC
Certified	Yes	NJ	WPP05.09050	NPW	Extract/GC (ECD)	[EPA 608]	Lindane (gamma BHC)
Certified	Yes	NJ	WPP05.09060	NPW	Extract/GC (ECD)	[EPA 608]	Chlordane
Certified	Yes	NJ	WPP05.09062	NPW	Extract/GC (ECD)	[EPA 608]	Chlordane (alpha)
Certified	Yes	NJ	WPP05.09063	NPW	Extract/GC (ECD)	[EPA 608]	Chlordane (gamma)
Applied	No	NJ	WPP05.09065	NPW	Extract/GC (ECD)	[EPA 608]	Chlorobenzilate
Certified	Yes	NJ	WPP05.09070	NPW	Extract/GC (ECD)	[EPA 608]	DDD (4,4'-)
Certified	Yes	NJ	WPP05.09080	NPW	Extract/GC (ECD)	[EPA 608]	DDE (4,4'-)
Certified	Yes	NJ	WPP05.09090	NPW	Extract/GC (ECD)	[EPA 608]	DDT (4,4'-)

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2235 RT 130
BLDG B
Dayton, NJ 08810

Category: WPP05 -- Organic Parameters, Chromatography

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	WPP05.09100	NPW	Extract/GC (ECD)	[EPA 608]	Dieldrin
Certified	Yes	NJ	WPP05.09110	NPW	Extract/GC (ECD)	[EPA 608]	Endosulfan I
Certified	Yes	NJ	WPP05.09120	NPW	Extract/GC (ECD)	[EPA 608]	Endosulfan II
Certified	Yes	NJ	WPP05.09130	NPW	Extract/GC (ECD)	[EPA 608]	Endosulfan sulfate
Certified	Yes	NJ	WPP05.09140	NPW	Extract/GC (ECD)	[EPA 608]	Endrin
Certified	Yes	NJ	WPP05.09150	NPW	Extract/GC (ECD)	[EPA 608]	Endrin aldehyde
Certified	Yes	NJ	WPP05.09160	NPW	Extract/GC (ECD)	[EPA 608]	Endrin ketone
Certified	Yes	NJ	WPP05.09170	NPW	Extract/GC (ECD)	[EPA 608]	Heptachlor
Certified	Yes	NJ	WPP05.09180	NPW	Extract/GC (ECD)	[EPA 608]	Heptachlor epoxide
Certified	Yes	NJ	WPP05.09190	NPW	Extract/GC (ECD)	[EPA 608]	Methoxychlor
Applied	No	NJ	WPP05.09198	NPW	Extract/GC (ECD)	[EPA 608]	Simazine
Certified	Yes	NJ	WPP05.09200	NPW	Extract/GC (ECD)	[EPA 608]	Toxaphene
Certified	Yes	NJ	WPP05.11010	NPW	Extract/GC (ECD)	[EPA 608]	PCB 1016
Certified	Yes	NJ	WPP05.11020	NPW	Extract/GC (ECD)	[EPA 608]	PCB 1221
Certified	Yes	NJ	WPP05.11030	NPW	Extract/GC (ECD)	[EPA 608]	PCB 1232
Certified	Yes	NJ	WPP05.11040	NPW	Extract/GC (ECD)	[EPA 608]	PCB 1242
Certified	Yes	NJ	WPP05.11050	NPW	Extract/GC (ECD)	[EPA 608]	PCB 1248
Certified	Yes	NJ	WPP05.11060	NPW	Extract/GC (ECD)	[EPA 608]	PCB 1254
Certified	Yes	NJ	WPP05.11070	NPW	Extract/GC (ECD)	[EPA 608]	PCB 1260

Category: WPP06 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Applied	No	NJ	WPP06.02001	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Amyl acetate (n-)
Applied	No	NJ	WPP06.02002	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Amyl alcohol (n-)
Certified	Yes	NJ	WPP06.02003	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Acetone
Certified	Yes	NJ	WPP06.02007	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Acrolein
Certified	Yes	NJ	WPP06.02009	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Acrylonitrile
Certified	Yes	NJ	WPP06.02010	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Benzene
Certified	Yes	NJ	WPP06.02020	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Bromodichloromethane

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2235 RT 130
BLDG B
Dayton, NJ 08810

Category: WPP06 – Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	WPP06.02030	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Bromoform
Certified	Yes	NJ	WPP06.02040	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Bromomethane
Certified	Yes	NJ	WPP06.02041	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Butanone (2-)
Certified	Yes	NJ	WPP06.02042	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Butyl acetate (n-)
Certified	Yes	NJ	WPP06.02045	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Carbon disulfide
Certified	Yes	NJ	WPP06.02050	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Carbon tetrachloride
Certified	Yes	NJ	WPP06.02060	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Chlorobenzene
Certified	Yes	NJ	WPP06.02070	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Chloroethane
Certified	Yes	NJ	WPP06.02080	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Chloroethyl vinyl ether (2-)
Certified	Yes	NJ	WPP06.02090	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Chloroform
Certified	Yes	NJ	WPP06.02100	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Chloromethane
Certified	Yes	NJ	WPP06.02110	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Dibromochloromethane
Certified	Yes	NJ	WPP06.02115	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Dibromoethane (1,2-) (EDB)
Certified	Yes	NJ	WPP06.02120	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Dichlorobenzene (1,2-)
Certified	Yes	NJ	WPP06.02130	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Dichlorobenzene (1,3-)
Certified	Yes	NJ	WPP06.02140	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Dichlorobenzene (1,4-)
Certified	Yes	NJ	WPP06.02145	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Dichlorodifluoromethane
Certified	Yes	NJ	WPP06.02150	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Dichloroethane (1,1-)
Certified	Yes	NJ	WPP06.02160	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Dichloroethane (1,2-)
Certified	Yes	NJ	WPP06.02170	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Dichloroethene (1,1-)
Certified	Yes	NJ	WPP06.02175	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Dichloroethene (cis-1,2-)
Certified	Yes	NJ	WPP06.02180	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Dichloroethene (trans-1,2-)
Certified	Yes	NJ	WPP06.02190	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Dichloropropane (1,2-)
Certified	Yes	NJ	WPP06.02198	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Diethyl ether (Ethyl ether)
Certified	Yes	NJ	WPP06.02200	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Dichloropropene (cis-1,3-)
Certified	Yes	NJ	WPP06.02210	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Dichloropropene (trans-1,3-)
Certified	Yes	NJ	WPP06.02212	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Ethyl acetate
Certified	Yes	NJ	WPP06.02220	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Ethylbenzene
Certified	Yes	NJ	WPP06.02222	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Heptane (n-)
Certified	Yes	NJ	WPP06.02223	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Hexane (n-)
Applied	No	NJ	WPP06.02224	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Isobutyraldehyde
Applied	No	NJ	WPP06.02225	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Isopropanol

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 02/24/2011 until 06/30/2011

Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: WPP06 – Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	WPP06.03020	NPW	Extract, GC/MS	[EPA 625]	Acenaphthylene
Certified	Yes	NJ	WPP06.03030	NPW	Extract, GC/MS	[EPA 625]	Anthracene
Certified	Yes	NJ	WPP06.03040	NPW	Extract, GC/MS	[EPA 625]	Benzo(a)anthracene
Certified	Yes	NJ	WPP06.03050	NPW	Extract, GC/MS	[EPA 625]	Benzo(b)fluoranthene
Certified	Yes	NJ	WPP06.03060	NPW	Extract, GC/MS	[EPA 625]	Benzo(k)fluoranthene
Certified	Yes	NJ	WPP06.03070	NPW	Extract, GC/MS	[EPA 625]	Benzo(a)pyrene
Certified	Yes	NJ	WPP06.03080	NPW	Extract, GC/MS	[EPA 625]	Benzo(ghi)perylene
Certified	Yes	NJ	WPP06.03090	NPW	Extract, GC/MS	[EPA 625]	Butyl benzyl phthalate
Certified	Yes	NJ	WPP06.03100	NPW	Extract, GC/MS	[EPA 625]	Bis (2-chloroethyl) ether
Certified	Yes	NJ	WPP06.03110	NPW	Extract, GC/MS	[EPA 625]	Bis (2-chloroethoxy) methane
Certified	Yes	NJ	WPP06.03120	NPW	Extract, GC/MS	[EPA 625]	Bis (2-ethylhexyl) phthalate
Certified	Yes	NJ	WPP06.03130	NPW	Extract, GC/MS	[EPA 625]	Bis (2-chloroisopropyl) ether
Certified	Yes	NJ	WPP06.03140	NPW	Extract, GC/MS	[EPA 625]	Bromophenyl-phenyl ether (4-)
Certified	Yes	NJ	WPP06.03150	NPW	Extract, GC/MS	[EPA 625]	Chloronaphthalene (2-)
Certified	Yes	NJ	WPP06.03160	NPW	Extract, GC/MS	[EPA 625]	Chlorophenyl-phenyl ether (4-)
Certified	Yes	NJ	WPP06.03170	NPW	Extract, GC/MS	[EPA 625]	Chrysene
Certified	Yes	NJ	WPP06.03178	NPW	Extract, GC/MS	[EPA 625]	Dibenz(a,h)acridine
Certified	Yes	NJ	WPP06.03180	NPW	Extract, GC/MS	[EPA 625]	Dibenzo(a,h)anthracene
Certified	Yes	NJ	WPP06.03186	NPW	Extract, GC/MS	[EPA 625]	Dibenzofuran
Certified	Yes	NJ	WPP06.03190	NPW	Extract, GC/MS	[EPA 625]	Di-n-butyl phthalate
Certified	Yes	NJ	WPP06.03230	NPW	Extract, GC/MS	[EPA 625]	Dichlorobenzidine (3,3'-)
Certified	Yes	NJ	WPP06.03240	NPW	Extract, GC/MS	[EPA 625]	Diethyl phthalate
Certified	Yes	NJ	WPP06.03244	NPW	Extract, GC/MS	[EPA 625]	Dimethylbenz(a)anthracene (7,12-)
Certified	Yes	NJ	WPP06.03250	NPW	Extract, GC/MS	[EPA 625]	Dimethyl phthalate
Certified	Yes	NJ	WPP06.03260	NPW	Extract, GC/MS	[EPA 625]	Dinitrotoluene (2,4-)
Certified	Yes	NJ	WPP06.03270	NPW	Extract, GC/MS	[EPA 625]	Dinitrotoluene (2,6-)
Certified	Yes	NJ	WPP06.03280	NPW	Extract, GC/MS	[EPA 625]	Di-n-octyl phthalate
Certified	Yes	NJ	WPP06.03290	NPW	Extract, GC/MS	[EPA 625]	Fluoranthene
Certified	Yes	NJ	WPP06.03300	NPW	Extract, GC/MS	[EPA 625]	Fluorene
Certified	Yes	NJ	WPP06.03310	NPW	Extract, GC/MS	[EPA 625]	Hexachlorobenzene
Certified	Yes	NJ	WPP06.03320	NPW	Extract, GC/MS	[EPA 625]	Hexachlorobutadiene (1,3-)
Certified	Yes	NJ	WPP06.03330	NPW	Extract, GC/MS	[EPA 625]	Hexachloroethane

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New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 02/24/2011 until 06/30/2011

Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: WPP06 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Applied	No	NJ	WPP06.02226	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Isopropyl acetate
Certified	Yes	NJ	WPP06.02227	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Isopropyl ether
Certified	Yes	NJ	WPP06.02230	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Methylene chloride (Dichloromethane)
Applied	No	NJ	WPP06.02231	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Methyl formate
Certified	Yes	NJ	WPP06.02232	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Methyl tert-butyl ether
Certified	Yes	NJ	WPP06.02233	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Methyl isobutyl ketone (MIBK)
Certified	Yes	NJ	WPP06.02234	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Tert-butyl alcohol
Certified	Yes	NJ	WPP06.02235	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Tetrahydrofuran
Certified	Yes	NJ	WPP06.02238	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Styrene
Certified	Yes	NJ	WPP06.02240	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Tetrachloroethane (1,1,2,2-)
Certified	Yes	NJ	WPP06.02250	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Tetrachloroethene
Certified	Yes	NJ	WPP06.02260	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Toluene
Certified	Yes	NJ	WPP06.02270	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Trichloroethane (1,1,1-)
Certified	Yes	NJ	WPP06.02280	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Trichloroethane (1,1,2-)
Certified	Yes	NJ	WPP06.02290	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Trichloroethene
Certified	Yes	NJ	WPP06.02300	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Trichlorofluoromethane
Certified	Yes	NJ	WPP06.02305	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Trichloro (1,1,2-) trifluoroethane (1,2,2-)
Certified	Yes	NJ	WPP06.02307	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Vinyl acetate
Certified	Yes	NJ	WPP06.02310	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Vinyl chloride
Certified	Yes	NJ	WPP06.02312	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Xylenes (total)
Certified	Yes	NJ	WPP06.02315	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Xylene (o-)
Certified	Yes	NJ	WPP06.02317	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Xylene (m- + p-)
Certified	Yes	NJ	WPP06.02325	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Hexanone (2-)
Certified	Yes	NJ	WPP06.02335	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Ethyl-tert-butyl Ether [ETBE]
Certified	Yes	NJ	WPP06.02400	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Diisopropyl Ether [DIPE]
Certified	Yes	NJ	WPP06.02410	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Dioxane (1,4-)
Certified	Yes	NJ	WPP06.02460	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Isopropylbenzene
Certified	Yes	NJ	WPP06.02510	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Naphthalene
Certified	Yes	NJ	WPP06.02570	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	tert-Amylmethyl ether [TAME]
Certified	Yes	NJ	WPP06.02650	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Trimethylbenzene (1,2,4-)
Certified	Yes	NJ	WPP06.02660	NPW	GC/MS, P & T, Capillary Column	[EPA 624]	Trimethylbenzene (1,3,5-)
Certified	Yes	NJ	WPP06.03010	NPW	Extract, GC/MS	[EPA 625]	Acenaphthene

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Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: WPP06 – Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	WPP06.03570	NPW	Extract, GC/MS	[EPA 625]	Aniline
Certified	Yes	NJ	WPP06.03580	NPW	Extract, GC/MS	[EPA 625]	Benzidine
Certified	Yes	NJ	WPP06.03590	NPW	Extract, GC/MS	[EPA 625]	Carbazole
Certified	Yes	NJ	WPP06.03600	NPW	Extract, GC/MS	[EPA 625]	Dichloroaniline (2,3-)
Certified	Yes	NJ	WPP06.03605	NPW	Extract, GC/MS	[EPA 625]	Diphenylhydrazine (1,2-)
Certified	Yes	NJ	WPP06.03610	NPW	Extract, GC/MS	[EPA 625]	Methylphenol (2-)
Certified	Yes	NJ	WPP06.03620	NPW	Extract, GC/MS	[EPA 625]	Decane (n-)
Certified	Yes	NJ	WPP06.03660	NPW	Extract, GC/MS	[EPA 625]	Hexachlorocyclopentadiene
Certified	Yes	NJ	WPP06.03675	NPW	Extract, GC/MS	[EPA 625]	N-Nitroso-di-n-butylamine
Certified	Yes	NJ	WPP06.03677	NPW	Extract, GC/MS	[EPA 625]	N-Nitrosodiethylamine
Certified	Yes	NJ	WPP06.03680	NPW	Extract, GC/MS	[EPA 625]	N-Nitrosodimethylamine
Certified	Yes	NJ	WPP06.03690	NPW	Extract, GC/MS	[EPA 625]	N-Nitrosodiphenylamine
Certified	Yes	NJ	WPP06.03695	NPW	Extract, GC/MS	[EPA 625]	N-Nitrosopyrrolidine
Certified	Yes	NJ	WPP06.03700	NPW	Extract, GC/MS	[EPA 625]	Octadecane (n-)
Certified	Yes	NJ	WPP06.03720	NPW	Extract, GC/MS	[EPA 625]	Pyridine
Certified	Yes	NJ	WPP06.03730	NPW	Extract, GC/MS	[EPA 625]	Methylphenanthrene (1-)

Category: WPP07 – Organic Parameters, Individual Pesticide

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	WPP07.11000	NPW	GC	[USER DEFINED EPA 608]	Beta BHC
Certified	Yes	NJ	WPP07.13000	NPW	GC	[USER DEFINED EPA 608]	Delta BHC
Certified	Yes	NJ	WPP07.20000	NPW	GC	[USER DEFINED EPA 608]	Chlordane
Certified	Yes	NJ	WPP07.45000	NPW	GC	[USER DEFINED EPA 608]	Endosulfan sulfate
Certified	Yes	NJ	WPP07.47000	NPW	GC	[USER DEFINED EPA 608]	Endrin
Certified	Yes	NJ	WPP07.62000	NPW	GC	[USER DEFINED EPA 608]	Methoxychlor
Certified	Yes	NJ	WPP07.85000	NPW	GC	[USER DEFINED EPA 608]	Toxaphene

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Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: WPP06 – Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	WPP06.03340	NPW	Extract, GC/MS	[EPA 625]	Indeno(1,2,3-cd)pyrene
Certified	Yes	NJ	WPP06.03350	NPW	Extract, GC/MS	[EPA 625]	Isophorone
Certified	Yes	NJ	WPP06.03358	NPW	Extract, GC/MS	[EPA 625]	Methylnaphthalene (2-)
Certified	Yes	NJ	WPP06.03360	NPW	Extract, GC/MS	[EPA 625]	Naphthalene
Certified	Yes	NJ	WPP06.03366	NPW	Extract, GC/MS	[EPA 625]	Chloroaniline (4-)
Certified	Yes	NJ	WPP06.03367	NPW	Extract, GC/MS	[EPA 625]	Nitroaniline (2-)
Certified	Yes	NJ	WPP06.03368	NPW	Extract, GC/MS	[EPA 625]	Nitroaniline (3-)
Certified	Yes	NJ	WPP06.03369	NPW	Extract, GC/MS	[EPA 625]	Nitroaniline (4-)
Certified	Yes	NJ	WPP06.03370	NPW	Extract, GC/MS	[EPA 625]	Nitrobenzene
Certified	Yes	NJ	WPP06.03380	NPW	Extract, GC/MS	[EPA 625]	N-Nitroso-di-n-propylamine
Certified	Yes	NJ	WPP06.03390	NPW	Extract, GC/MS	[EPA 625]	Phenanthrene
Certified	Yes	NJ	WPP06.03400	NPW	Extract, GC/MS	[EPA 625]	Pyrene
Certified	Yes	NJ	WPP06.03402	NPW	Extract, GC/MS	[EPA 625]	Pentachlorobenzene
Certified	Yes	NJ	WPP06.03405	NPW	Extract, GC/MS	[EPA 625]	Tetrachlorobenzene (1,2,4,5-)
Certified	Yes	NJ	WPP06.03410	NPW	Extract, GC/MS	[EPA 625]	Trichlorobenzene (1,2,4-)
Certified	Yes	NJ	WPP06.03420	NPW	Extract, GC/MS	[EPA 625]	Methyl phenol (4-chloro-3-)
Certified	Yes	NJ	WPP06.03430	NPW	Extract, GC/MS	[EPA 625]	Chlorophenol (2-)
Certified	Yes	NJ	WPP06.03440	NPW	Extract, GC/MS	[EPA 625]	Dichlorophenol (2,4-)
Certified	Yes	NJ	WPP06.03450	NPW	Extract, GC/MS	[EPA 625]	Dimethylphenol (2,4-)
Certified	Yes	NJ	WPP06.03460	NPW	Extract, GC/MS	[EPA 625]	Dinitrophenol (2,4-)
Certified	Yes	NJ	WPP06.03470	NPW	Extract, GC/MS	[EPA 625]	Dinitrophenol (2-methyl-4,6-)
Certified	Yes	NJ	WPP06.03480	NPW	Extract, GC/MS	[EPA 625]	Nitrophenol (2-)
Certified	Yes	NJ	WPP06.03490	NPW	Extract, GC/MS	[EPA 625]	Nitrophenol (4-)
Certified	Yes	NJ	WPP06.03500	NPW	Extract, GC/MS	[EPA 625]	Pentachlorophenol
Certified	Yes	NJ	WPP06.03510	NPW	Extract, GC/MS	[EPA 625]	Phenol
Certified	Yes	NJ	WPP06.03512	NPW	Extract, GC/MS	[EPA 625]	Tetrachlorophenol (2,3,4,6-)
Certified	Yes	NJ	WPP06.03518	NPW	Extract, GC/MS	[EPA 625]	Trichlorophenol (2,4,5-)
Certified	Yes	NJ	WPP06.03520	NPW	Extract, GC/MS	[EPA 625]	Trichlorophenol (2,4,6-)
Certified	Yes	NJ	WPP06.03530	NPW	Extract, GC/MS	[EPA 625]	Benzoic acid
Certified	Yes	NJ	WPP06.03540	NPW	Extract, GC/MS	[EPA 625]	Methylphenol (4-)
Certified	Yes	NJ	WPP06.03550	NPW	Extract, GC/MS	[EPA 625]	Acetophenone
Certified	Yes	NJ	WPP06.03560	NPW	Extract, GC/MS	[EPA 625]	Alpha - terpineol

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Effective as of 02/24/2011 until 06/30/2011

Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: SHW04 -- Inorganic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW04.17500	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Calcium
Certified	Yes	NJ	SHW04.17505	NPW, SCM	ICP/MS	[SW-846 6020A] [SW-846 6020]	Calcium
Certified	Yes	NJ	SHW04.18500	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Chromium
Certified	Yes	NJ	SHW04.19000	NPW, SCM	ICP/MS	[SW-846 6020A] [SW-846 6020]	Chromium
Certified	Yes	NJ	SHW04.21000	NPW, SCM	Colorimetric	[SW-846 7196A]	Chromium (VI)
Certified	Yes	NJ	SHW04.22100	NPW, SCM	Ion Chromatography	[SW-846 7199]	Chromium (VI)
Certified	Yes	NJ	SHW04.22500	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Cobalt
Certified	Yes	NJ	SHW04.23000	NPW, SCM	ICP/MS	[SW-846 6020A] [SW-846 6020]	Cobalt
Certified	Yes	NJ	SHW04.24500	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Copper
Certified	Yes	NJ	SHW04.25000	NPW, SCM	ICP/MS	[SW-846 6020A] [SW-846 6020]	Copper
Certified	Yes	NJ	SHW04.26000	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Iron
Certified	Yes	NJ	SHW04.26005	NPW, SCM	ICP/MS	[SW-846 6020A] [SW-846 6020]	Iron
Certified	Yes	NJ	SHW04.27500	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Lead
Certified	Yes	NJ	SHW04.28000	NPW, SCM	ICP/MS	[SW-846 6020A] [SW-846 6020]	Lead
Certified	Yes	NJ	SHW04.30500	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Magnesium
Certified	Yes	NJ	SHW04.30505	NPW, SCM	ICP/MS	[SW-846 6020A] [SW-846 6020]	Magnesium
Certified	Yes	NJ	SHW04.31500	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Manganese
Certified	Yes	NJ	SHW04.31600	NPW, SCM	ICP/MS	[SW-846 6020A] [SW-846 6020]	Manganese
Certified	Yes	NJ	SHW04.34000	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Molybdenum
Certified	Yes	NJ	SHW04.34005	NPW, SCM	ICP/MS	[SW-846 6020A] [SW-846 6020]	Molybdenum
Certified	Yes	NJ	SHW04.35500	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Nickel
Certified	Yes	NJ	SHW04.36000	NPW, SCM	ICP/MS	[SW-846 6020A] [SW-846 6020]	Nickel
Certified	Yes	NJ	SHW04.38000	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Potassium
Certified	Yes	NJ	SHW04.38505	NPW, SCM	ICP/MS	[SW-846 6020A] [SW-846 6020]	Potassium
Certified	Yes	NJ	SHW04.39000	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Selenium
Certified	Yes	NJ	SHW04.40600	NPW, SCM	ICP/MS	[SW-846 6020A] [SW-846 6020]	Selenium
Certified	Yes	NJ	SHW04.41000	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Silver
Certified	Yes	NJ	SHW04.41500	NPW, SCM	ICP/MS	[SW-846 6020A] [SW-846 6020]	Silver
Certified	Yes	NJ	SHW04.43000	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Sodium
Certified	Yes	NJ	SHW04.43005	NPW, SCM	ICP/MS	[SW-846 6020A] [SW-846 6020]	Sodium
Certified	Yes	NJ	SHW04.44000	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Strontium
Applied	No	NJ	SHW04.44001	NPW, SCM	ICP/MS	[SW-846 6020A] [SW-846 6020]	Strontium

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Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: SHW02 -- Characteristics of Hazardous Waste

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW02.01000	NPW, SCM	Pensky Martens	[SW-846 1010A]	Ignitability
Certified	Yes	NJ	SHW02.03000	NPW, SCM	Aqueous Waste, Potentiometric	[SW-846 9040C]	Corrosivity - pH waste, >20% water
Certified	Yes	NJ	SHW02.06900	NPW, SCM	TCLP, Toxicity Procedure, ZHE	[SW-846 1311]	Volatile organics
Certified	Yes	NJ	SHW02.06950	NPW, SCM	TCLP, Toxicity Procedure, Shaker	[SW-846 1311]	Semivolatile organics
Certified	Yes	NJ	SHW02.07000	NPW, SCM	TCLP, Toxicity Procedure, Shaker	[SW-846 1311]	Metals
Certified	Yes	NJ	SHW02.08000	NPW, SCM	Synthetic PPT Leachate Procedure	[SW-846 1312]	Metals - organics
Certified	Yes	NJ	SHW02.09000	NPW, SCM	Multiple Extractions	[SW-846 1320]	Metals - organics

Category: SHW03 -- Analyze-Immediately Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW03.01000	NPW, SCM	Aqueous, Electrometric	[SW-846 9040C]	pH

Category: SHW04 -- Inorganic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW04.05000	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Aluminum
Certified	Yes	NJ	SHW04.05500	NPW, SCM	ICP/MS	[SW-846 6020A] [SW-846 6020]	Aluminum
Certified	Yes	NJ	SHW04.06500	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Antimony
Certified	Yes	NJ	SHW04.07000	NPW, SCM	ICP/MS	[SW-846 6020A] [SW-846 6020]	Antimony
Certified	Yes	NJ	SHW04.09000	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Arsenic
Certified	Yes	NJ	SHW04.09500	NPW, SCM	ICP/MS	[SW-846 6020A] [SW-846 6020]	Arsenic
Certified	Yes	NJ	SHW04.11500	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Barium
Certified	Yes	NJ	SHW04.12000	NPW, SCM	ICP/MS	[SW-846 6020A] [SW-846 6020]	Barium
Certified	Yes	NJ	SHW04.13500	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Beryllium
Certified	Yes	NJ	SHW04.14000	NPW, SCM	ICP/MS	[SW-846 6020A] [SW-846 6020]	Beryllium
Certified	Yes	NJ	SHW04.15100	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Boron
Certified	Yes	NJ	SHW04.15500	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Cadmium
Certified	Yes	NJ	SHW04.16000	NPW, SCM	ICP/MS	[SW-846 6020A] [SW-846 6020]	Cadmium

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 02/24/2011 until 06/30/2011

Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: SHW06 -- Organic Parameters, Chromatography

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW06.05010	NPW, SCM	GC, Direct Injection or P & T, PID-HECD	[SW-846 8021B, Rev. 2, 12/96]	Benzene
Certified	Yes	NJ	SHW06.05020	NPW, SCM	GC, Direct Injection or P & T, PID-HECD	[SW-846 8021B, Rev. 2, 12/96]	Chlorobenzene
Certified	Yes	NJ	SHW06.05030	NPW, SCM	GC, Direct Injection or P & T, PID-HECD	[SW-846 8021B, Rev. 2, 12/96]	Dichlorobenzene (1,2-)
Certified	Yes	NJ	SHW06.05040	NPW, SCM	GC, Direct Injection or P & T, PID-HECD	[SW-846 8021B, Rev. 2, 12/96]	Dichlorobenzene (1,3-)
Certified	Yes	NJ	SHW06.05050	NPW, SCM	GC, Direct Injection or P & T, PID-HECD	[SW-846 8021B, Rev. 2, 12/96]	Dichlorobenzene (1,4-)
Certified	Yes	NJ	SHW06.05060	NPW, SCM	GC, Direct Injection or P & T, PID-HECD	[SW-846 8021B, Rev. 2, 12/96]	Ethylbenzene
Certified	Yes	NJ	SHW06.05068	NPW, SCM	GC, Direct Injection or P & T, PID-HECD	[SW-846 8021B, Rev. 2, 12/96]	Styrene
Certified	Yes	NJ	SHW06.05070	NPW, SCM	GC, Direct Injection or P & T, PID-HECD	[SW-846 8021B, Rev. 2, 12/96]	Toluene
Certified	Yes	NJ	SHW06.05080	NPW, SCM	GC, Direct Injection or P & T, PID-HECD	[SW-846 8021B, Rev. 2, 12/96]	Xylene (o-)
Certified	Yes	NJ	SHW06.05090	NPW, SCM	GC, Direct Injection or P & T, PID-HECD	[SW-846 8021B, Rev. 2, 12/96]	Xylene (m-)
Certified	Yes	NJ	SHW06.05100	NPW, SCM	GC, Direct Injection or P & T, PID-HECD	[SW-846 8021B, Rev. 2, 12/96]	Xylene (p-)
Applied	No	NJ	SHW06.05105	NPW, SCM	GC, Direct Injection or P & T, PID-HECD	[SW-846 8021B]	Xylenes (total)
Certified	Yes	NJ	SHW06.05180	NPW, SCM	GC, Direct Injection or P & T, PID-HECD	[SW-846 8021B, Rev. 2, 12/96]	Dichloropropene (trans-1,3-)
Certified	Yes	NJ	SHW06.05240	NPW, SCM	GC, Direct Injection or P & T, PID-HECD	[SW-846 8021B, Rev. 2, 12/96]	Dichloroethene (cis-1,2-)
Certified	Yes	NJ	SHW06.05250	NPW, SCM	GC, Direct Injection or P & T, PID-HECD	[SW-846 8021B, Rev. 2, 12/96]	Dichloroethene (trans-1,2-)
Certified	Yes	NJ	SHW06.05270	NPW, SCM	GC, Direct Injection or P & T, PID-HECD	[SW-846 8021B, Rev. 2, 12/96]	Dichloropropene (cis-1,3-)
Certified	Yes	NJ	SHW06.05300	NPW, SCM	GC, Direct Injection or P & T, PID-HECD	[SW-846 8021B, Rev. 2, 12/96]	Tetrachloroethene
Certified	Yes	NJ	SHW06.05330	NPW, SCM	GC, Direct Injection or P & T, PID-HECD	[SW-846 8021B, Rev. 2, 12/96]	Trichloroethene
Certified	Yes	NJ	SHW06.05360	NPW, SCM	GC, Direct Injection or P & T, PID-HECD	[SW-846 8021B, Rev. 2, 12/96]	Methyl tert-butyl ether
Certified	Yes	NJ	SHW06.12010	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A] [SW-846 8081B]	Aldrin
Certified	Yes	NJ	SHW06.12020	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A] [SW-846 8081B]	Alpha BHC
Certified	Yes	NJ	SHW06.12030	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A] [SW-846 8081B]	Beta BHC
Certified	Yes	NJ	SHW06.12040	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A] [SW-846 8081B]	Delta BHC
Certified	Yes	NJ	SHW06.12050	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A] [SW-846 8081B]	Lindane (gamma BHC)
Certified	Yes	NJ	SHW06.12060	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A] [SW-846 8081B]	Chlordane (technical)
Certified	Yes	NJ	SHW06.12070	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A] [SW-846 8081B]	Chlordane (alpha)
Certified	Yes	NJ	SHW06.12080	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A] [SW-846 8081B]	Chlordane (gamma)
Certified	Yes	NJ	SHW06.12090	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A] [SW-846 8081B]	DDD (4,4'-)
Certified	Yes	NJ	SHW06.12100	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A] [SW-846 8081B]	DDE (4,4'-)
Certified	Yes	NJ	SHW06.12110	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A] [SW-846 8081B]	DDT (4,4'-)
Certified	Yes	NJ	SHW06.12120	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A] [SW-846 8081B]	Dieldrin
Certified	Yes	NJ	SHW06.12130	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A] [SW-846 8081B]	Endosulfan I

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New Jersey Department of Environmental Protection

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ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 02/24/2011 until 06/30/2011

Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: SHW04 -- Inorganic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW04.45000	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Thallium
Certified	Yes	NJ	SHW04.45500	NPW, SCM	ICP/MS	[SW-846 6020A] [SW-846 6020]	Thallium
Certified	Yes	NJ	SHW04.47100	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Tin
Certified	Yes	NJ	SHW04.47105	NPW, SCM	ICP/MS	[SW-846 6020A] [SW-846 6020]	Tin
Certified	Yes	NJ	SHW04.47145	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Titanium
Applied	No	NJ	SHW04.47150	NPW, SCM	ICP/MS	[SW-846 6020A]	Titanium
Certified	Yes	NJ	SHW04.47500	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Vanadium
Certified	Yes	NJ	SHW04.47505	NPW, SCM	ICP/MS	[SW-846 6020A] [SW-846 6020]	Vanadium
Certified	Yes	NJ	SHW04.49000	NPW, SCM	ICP	[SW-846 6010B] [SW-846 6010C]	Zinc
Certified	Yes	NJ	SHW04.49500	NPW, SCM	ICP/MS	[SW-846 6020A] [SW-846 6020]	Zinc
Applied	No	NJ	SHW04.51045	NPW, SCM	ICP	[SW-846 6010B]	Zirconium

Category: SHW06 -- Organic Parameters, Chromatography

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW06.02010	NPW, SCM	Microextraction, GC, ECD	[SW-846 8011, Rev. 0, 7/92]	Dibromoethane (1,2-) (EDB)
Certified	Yes	NJ	SHW06.02020	NPW, SCM	Microextraction, GC, ECD	[SW-846 8011, Rev. 0, 7/92]	Dibromo-3-chloropropane (1,2-)
Certified	Yes	NJ	SHW06.02030	NPW, SCM	Microextraction, GC, ECD	[SW-846 8011, Rev. 0, 7/92]	Trichloropropane (1,2,3-)
Certified	Yes	NJ	SHW06.03048	NPW, SCM	GC, Direct Injection or P & T, FID	[SW-846 8015B] [SW-846 8015C]	Butanol (1-)
Certified	Yes	NJ	SHW06.03050	NPW, SCM	GC, Direct Injection or P & T, FID	[SW-846 8015B] [SW-846 8015C]	Tert-butyl alcohol
Certified	Yes	NJ	SHW06.03090	NPW, SCM	GC, Direct Injection or P & T, FID	[SW-846 8015B] [SW-846 8015C]	Iso-butyl alcohol
Certified	Yes	NJ	SHW06.03142	NPW, SCM	GC, Direct Injection or P & T, FID	[SW-846 8015B] [SW-846 8015C]	Propyl Alcohol (n-)
Certified	Yes	NJ	SHW06.03145	NPW, SCM	GC, Direct Injection or P & T, FID	[SW-846 8015B] [SW-846 8015C]	Isopropyl alcohol
Certified	Yes	NJ	SHW06.03180	NPW, SCM	GC, Direct Injection or P & T, FID	[SW-846 8015B] [SW-846 8015C]	Methyl alcohol (Methanol)
Certified	Yes	NJ	SHW06.03778	NPW, SCM	GC, Direct Injection or P & T, FID	[SW-846 8015B] [SW-846 8015C]	Ethyl alcohol
Certified	Yes	NJ	SHW06.04010	NPW, SCM	GC P&T, FID	[SW-846 8015B] [SW-846 8015C]	Gasoline range organic
Certified	Yes	NJ	SHW06.04500	NPW, SCM	Extraction, GC, FID	[SW-846 8015B] [SW-846 8015C]	Diesel range organic
Certified	Yes	NJ	SHW06.04505	NPW, SCM	Extraction, GC, FID	[USER DEFINED TCEQ 1005]	Diesel range organic
Certified	Yes	NJ	SHW06.04520	NPW, SCM	Extraction, GC, FID	[OTHER NJ-OQA-QAM-025, Rev. 7]	Petroleum Organics
Certified	Yes	NJ	SHW06.04540	NPW, SCM	Extraction, GC, FID	[OTHER NJDEP EPH 10/08, Rev. 3]	Extractable Petroleum Hydrocarbons

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Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: SHW06 – Organic Parameters, Chromatography

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW06.16140	NPW, SCM	GC, Extraction or Direct Inject, FID	[SW-846 8100, Rev. 0, 9/86]	Naphthalene
Certified	Yes	NJ	SHW06.16150	NPW, SCM	GC, Extraction or Direct Inject, FID	[SW-846 8100, Rev. 0, 9/86]	Phenanthrene
Certified	Yes	NJ	SHW06.16160	NPW, SCM	GC, Extraction or Direct Inject, FID	[SW-846 8100, Rev. 0, 9/86]	Pyrene
Certified	Yes	NJ	SHW06.23010	NPW, SCM	GC, Extraction, ECD, Capillary	[SW-846 8151A, Rev 1, 9/96]	Dalapon
Certified	Yes	NJ	SHW06.23020	NPW, SCM	GC, Extraction, ECD, Capillary	[SW-846 8151A, Rev 1, 9/96]	Dicamba
Certified	Yes	NJ	SHW06.23021	NPW, SCM	GC, Extraction, ECD, Capillary	[SW-846 8151A, Rev. 1, 9/96]	Dichlorprop
Certified	Yes	NJ	SHW06.23030	NPW, SCM	GC, Extraction, ECD, Capillary	[SW-846 8151A, Rev 1, 9/96]	Dinoseb
Certified	Yes	NJ	SHW06.23040	NPW, SCM	GC, Extraction, ECD, Capillary	[SW-846 8151A, Rev 1, 9/96]	D (2,4-)
Certified	Yes	NJ	SHW06.23041	NPW, SCM	GC, Extraction, ECD, Capillary	[SW-846 8151A, Rev. 1, 9/96]	DB (2,4-)
Certified	Yes	NJ	SHW06.23050	NPW, SCM	GC, Extraction, ECD, Capillary	[SW-846 8151A, Rev 1, 9/96]	T (2,4,5-)
Certified	Yes	NJ	SHW06.23060	NPW, SCM	GC, Extraction, ECD, Capillary	[SW-846 8151A, Rev 1, 9/96]	TP (2,4,5-) (Silvex)
Certified	Yes	NJ	SHW06.23063	NPW, SCM	GC, Extraction, ECD, Capillary	[SW-846 8151A, Rev. 1, 9/96]	MCPA
Certified	Yes	NJ	SHW06.23064	NPW, SCM	GC, Extraction, ECD, Capillary	[SW-846 8151A, Rev. 1, 9/96]	MCPP
Certified	Yes	NJ	SHW06.23066	NPW, SCM	GC, Extraction, ECD, Capillary	[SW-846 8151A, Rev. 1, 9/96]	Pentachlorophenol
Certified	Yes	NJ	SHW06.23070	NPW, SCM	GC, Extraction, ECD, Capillary	[SW-846 8151A, Rev 1, 9/96]	Picloram
Certified	Yes	NJ	SHW06.23100	NPW, SCM	GC, Headspace, FID	[OTHER J. Chrom. Sci. RSK-175]	Ethane
Certified	Yes	NJ	SHW06.23105	NPW, SCM	GC, Headspace, FID	[OTHER J. Chrom. Sci. RSK-175]	Ethene
Certified	Yes	NJ	SHW06.23110	NPW, SCM	GC, Headspace, FID	[OTHER J. Chrom. Sci. RSK-175]	Methane
Certified	Yes	NJ	SHW06.24110	NPW, SCM	Extraction, HPLC	[SW-846 8310, Rev. 0, 9/86]	Acenaphthene
Certified	Yes	NJ	SHW06.24120	NPW, SCM	Extraction, HPLC	[SW-846 8310, Rev. 0, 9/86]	Acenaphthylene
Certified	Yes	NJ	SHW06.24130	NPW, SCM	Extraction, HPLC	[SW-846 8310, Rev. 0, 9/86]	Anthracene
Certified	Yes	NJ	SHW06.24140	NPW, SCM	Extraction, HPLC	[SW-846 8310, Rev. 0, 9/86]	Benzo(a)anthracene
Certified	Yes	NJ	SHW06.24150	NPW, SCM	Extraction, HPLC	[SW-846 8310, Rev. 0, 9/86]	Benzo(a)pyrene
Certified	Yes	NJ	SHW06.24160	NPW, SCM	Extraction, HPLC	[SW-846 8310, Rev. 0, 9/86]	Benzo(b)fluoranthene
Certified	Yes	NJ	SHW06.24170	NPW, SCM	Extraction, HPLC	[SW-846 8310, Rev. 0, 9/86]	Benzo(ghi)perylene
Certified	Yes	NJ	SHW06.24180	NPW, SCM	Extraction, HPLC	[SW-846 8310, Rev. 0, 9/86]	Benzo(k)fluoranthene
Certified	Yes	NJ	SHW06.24190	NPW, SCM	Extraction, HPLC	[SW-846 8310, Rev. 0, 9/86]	Chrysene
Certified	Yes	NJ	SHW06.24200	NPW, SCM	Extraction, HPLC	[SW-846 8310, Rev. 0, 9/86]	Dibenzo(a,h)anthracene
Certified	Yes	NJ	SHW06.24210	NPW, SCM	Extraction, HPLC	[SW-846 8310, Rev. 0, 9/86]	Fluoranthene
Certified	Yes	NJ	SHW06.24220	NPW, SCM	Extraction, HPLC	[SW-846 8310, Rev. 0, 9/86]	Fluorene
Certified	Yes	NJ	SHW06.24230	NPW, SCM	Extraction, HPLC	[SW-846 8310, Rev. 0, 9/86]	Indeno(1,2,3-cd)pyrene
Certified	Yes	NJ	SHW06.24240	NPW, SCM	Extraction, HPLC	[SW-846 8310, Rev. 0, 9/86]	Naphthalene

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2235 RT 130
BLDG B
Dayton, NJ 08810

Category: SHW06 – Organic Parameters, Chromatography

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW06.12140	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A] [SW-846 8081B]	Endosulfan II
Certified	Yes	NJ	SHW06.12150	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A] [SW-846 8081B]	Endosulfan sulfate
Certified	Yes	NJ	SHW06.12160	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A] [SW-846 8081B]	Endrin
Certified	Yes	NJ	SHW06.12170	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A] [SW-846 8081B]	Endrin aldehyde
Certified	Yes	NJ	SHW06.12180	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A] [SW-846 8081B]	Endrin ketone
Certified	Yes	NJ	SHW06.12190	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A] [SW-846 8081B]	Heptachlor
Certified	Yes	NJ	SHW06.12200	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A] [SW-846 8081B]	Heptachlor epoxide
Certified	Yes	NJ	SHW06.12210	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A] [SW-846 8081B]	Methoxychlor
Certified	Yes	NJ	SHW06.12212	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A] [SW-846 8081B]	Mirex
Certified	Yes	NJ	SHW06.12220	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A] [SW-846 8081B]	Toxaphene
Certified	Yes	NJ	SHW06.13110	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8082, Rev. 0, 12/96]	PCB 1016
Certified	Yes	NJ	SHW06.13120	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8082, Rev. 0, 12/96]	PCB 1221
Certified	Yes	NJ	SHW06.13130	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8082, Rev. 0, 12/96]	PCB 1232
Certified	Yes	NJ	SHW06.13140	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8082, Rev. 0, 12/96]	PCB 1242
Certified	Yes	NJ	SHW06.13150	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8082, Rev. 0, 12/96]	PCB 1248
Certified	Yes	NJ	SHW06.13160	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8082, Rev. 0, 12/96]	PCB 1254
Certified	Yes	NJ	SHW06.13170	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8082, Rev. 0, 12/96]	PCB 1260
Applied	No	NJ	SHW06.13175	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8082A]	PCB-1262
Applied	No	NJ	SHW06.13180	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8082A]	PCB-1268
Certified	Yes	NJ	SHW06.16010	NPW, SCM	GC, Extraction or Direct Inject, FID	[SW-846 8100, Rev. 0, 9/86]	Acenaphthene
Certified	Yes	NJ	SHW06.16020	NPW, SCM	GC, Extraction or Direct Inject, FID	[SW-846 8100, Rev. 0, 9/86]	Acenaphthylene
Certified	Yes	NJ	SHW06.16030	NPW, SCM	GC, Extraction or Direct Inject, FID	[SW-846 8100, Rev. 0, 9/86]	Anthracene
Certified	Yes	NJ	SHW06.16040	NPW, SCM	GC, Extraction or Direct Inject, FID	[SW-846 8100, Rev. 0, 9/86]	Benzo(a)anthracene
Certified	Yes	NJ	SHW06.16050	NPW, SCM	GC, Extraction or Direct Inject, FID	[SW-846 8100, Rev. 0, 9/86]	Benzo(a)pyrene
Certified	Yes	NJ	SHW06.16060	NPW, SCM	GC, Extraction or Direct Inject, FID	[SW-846 8100, Rev. 0, 9/86]	Benzo(b)fluoranthene
Certified	Yes	NJ	SHW06.16070	NPW, SCM	GC, Extraction or Direct Inject, FID	[SW-846 8100, Rev. 0, 9/86]	Benzo(k)fluoranthene
Certified	Yes	NJ	SHW06.16080	NPW, SCM	GC, Extraction or Direct Inject, FID	[SW-846 8100, Rev. 0, 9/86]	Benzo(ghi)perylene
Certified	Yes	NJ	SHW06.16090	NPW, SCM	GC, Extraction or Direct Inject, FID	[SW-846 8100, Rev. 0, 9/86]	Chrysene
Certified	Yes	NJ	SHW06.16100	NPW, SCM	GC, Extraction or Direct Inject, FID	[SW-846 8100, Rev. 0, 9/86]	Dibenzo(a,h)anthracene
Certified	Yes	NJ	SHW06.16110	NPW, SCM	GC, Extraction or Direct Inject, FID	[SW-846 8100, Rev. 0, 9/86]	Fluoranthene
Certified	Yes	NJ	SHW06.16120	NPW, SCM	GC, Extraction or Direct Inject, FID	[SW-846 8100, Rev. 0, 9/86]	Fluorene
Certified	Yes	NJ	SHW06.16130	NPW, SCM	GC, Extraction or Direct Inject, FID	[SW-846 8100, Rev. 0, 9/86]	Indeno(1,2,3-cd)pyrene

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New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 02/24/2011 until 06/30/2011

Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: SHW07 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW07.04083	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Xylene (p-)
Certified	Yes	NJ	SHW07.04087	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	tert-Amylmethyl ether [TAME]
Certified	Yes	NJ	SHW07.04088	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Allyl chloride
Certified	Yes	NJ	SHW07.04089	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Bromochloromethane
Certified	Yes	NJ	SHW07.04090	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Bromodichloromethane
Certified	Yes	NJ	SHW07.04100	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Bromoform
Certified	Yes	NJ	SHW07.04110	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Bromomethane
Certified	Yes	NJ	SHW07.04111	NPW, SCM	GC/MS, P&T, or Direct Injection, Capillary	[SW-846 8260B]	Cyclohexane
Certified	Yes	NJ	SHW07.04112	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Cyclohexanone
Certified	Yes	NJ	SHW07.04115	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Butadiene (2-chloro-1,3-)
Certified	Yes	NJ	SHW07.04120	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Carbon tetrachloride
Certified	Yes	NJ	SHW07.04130	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Chloroethane
Certified	Yes	NJ	SHW07.04140	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Chloroethyl vinyl ether (2-)
Certified	Yes	NJ	SHW07.04150	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Chloroform
Certified	Yes	NJ	SHW07.04160	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Chloromethane
Certified	Yes	NJ	SHW07.04165	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Diethyl ether (Ethyl ether)
Certified	Yes	NJ	SHW07.04170	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloropropene (trans-1,3-)
Certified	Yes	NJ	SHW07.04180	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dibromochloromethane
Certified	Yes	NJ	SHW07.04185	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dibromoethane (1,2-) (EDB)
Certified	Yes	NJ	SHW07.04186	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dibromomethane
Certified	Yes	NJ	SHW07.04187	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dibromo-3-chloropropane (1,2-)
Certified	Yes	NJ	SHW07.04190	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichlorodifluoromethane
Certified	Yes	NJ	SHW07.04200	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloroethane (1,1-)
Certified	Yes	NJ	SHW07.04210	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloroethane (1,2-)
Certified	Yes	NJ	SHW07 04220	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloroethene (1,1-)
Certified	Yes	NJ	SHW07.04230	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloroethene (trans-1,2-)
Certified	Yes	NJ	SHW07.04235	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloroethene (cis-1,2-)
Certified	Yes	NJ	SHW07.04240	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloropropane (1,2-)
Certified	Yes	NJ	SHW07.04241	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloropropane (1,3-)
Certified	Yes	NJ	SHW07.04242	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloropropane (2,2-)
Certified	Yes	NJ	SHW07.04249	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloropropene (1,1-)
Certified	Yes	NJ	SHW07.04250	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloropropene (cis-1,3-)

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Effective as of 02/24/2011 until 06/30/2011

Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: SHW06 – Organic Parameters, Chromatography

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW06.24250	NPW, SCM	Extraction, HPLC	[SW-846 8310, Rev. 0, 9/86]	Phenanthrene
Certified	Yes	NJ	SHW06.24260	NPW, SCM	Extraction, HPLC	[SW-846 8310, Rev. 0, 9/86]	Pyrene

Category: SHW07 – Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW07.04004	NPW, SCM	GC/MS/SIM, Direct Aqueous Injection	[USER DEFINED SW-846 8260B]	Ethylene glycol
Certified	Yes	NJ	SHW07.04006	NPW, SCM	GC/MS/SIM, Direct Aqueous Injection	[USER DEFINED SW-846 8260B]	Propylene glycol
Certified	Yes	NJ	SHW07.04010	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Benzene
Certified	Yes	NJ	SHW07.04011	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Bromobenzene
Certified	Yes	NJ	SHW07.04012	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Butyl benzene (n-)
Certified	Yes	NJ	SHW07.04013	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Sec-butylbenzene
Certified	Yes	NJ	SHW07.04014	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Tert-butylbenzene
Certified	Yes	NJ	SHW07.04020	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Chlorobenzene
Certified	Yes	NJ	SHW07.04022	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Chlorotoluene (2-)
Certified	Yes	NJ	SHW07.04023	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Chlorotoluene (4-)
Certified	Yes	NJ	SHW07.04030	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichlorobenzene (1,2-)
Certified	Yes	NJ	SHW07.04040	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichlorobenzene (1,3-)
Certified	Yes	NJ	SHW07.04050	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichlorobenzene (1,4-)
Certified	Yes	NJ	SHW07.04060	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Ethylbenzene
Certified	Yes	NJ	SHW07.04065	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Isopropylbenzene
Certified	Yes	NJ	SHW07.04067	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Propylbenzene (n-)
Certified	Yes	NJ	SHW07.04070	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Toluene
Certified	Yes	NJ	SHW07.04071	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Isopropyltoluene (4-)
Certified	Yes	NJ	SHW07.04072	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trichlorobenzene (1,2,3-)
Certified	Yes	NJ	SHW07.04073	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trimethylbenzene (1,2,4-)
Certified	Yes	NJ	SHW07.04074	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trimethylbenzene (1,3,5-)
Certified	Yes	NJ	SHW07.04080	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Xylenes (total)
Certified	Yes	NJ	SHW07.04081	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Xylene (m-)
Certified	Yes	NJ	SHW07.04082	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Xylene (o-)

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Effective as of 02/24/2011 until 06/30/2011

Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: SHW07 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW07.04385	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Propionitrile
Certified	Yes	NJ	SHW07.04390	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Methyl tert-butyl ether
Certified	Yes	NJ	SHW07.04395	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Tert-butyl alcohol
Certified	Yes	NJ	SHW07.04398	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Acetonitrile
Certified	Yes	NJ	SHW07.04400	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Acrolein
Certified	Yes	NJ	SHW07.04410	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Acrylonitrile
Certified	Yes	NJ	SHW07.04500	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Hexachlorobutadiene (1,3-)
Certified	Yes	NJ	SHW07.04530	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Hexachloroethane
Certified	Yes	NJ	SHW07.04535	NPW, SCM	GC/MS, P&T, or Direct Injection, Capillary	[SW-846 8260B]	Methylcyclohexane
Certified	Yes	NJ	SHW07.04540	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260C, Rev. 2, 12/96]	Naphthalene
Certified	Yes	NJ	SHW07.04550	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Styrene
Certified	Yes	NJ	SHW07.04560	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Tetrachloroethane (1,1,1,2-)
Certified	Yes	NJ	SHW07.04570	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trichlorobenzene (1,2,4-)
Certified	Yes	NJ	SHW07.04572	NPW, SCM	GC/MS, Extract, or Direct Injection, Capillary	[SW-846 8260B]	Trimethylpentane (2,2,4-)
Certified	Yes	NJ	SHW07.04590	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dioxane (1,4-)
Certified	Yes	NJ	SHW07.04660	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Alpha - terpineol
Certified	Yes	NJ	SHW07.04665	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Acetophenone
Certified	Yes	NJ	SHW07.04670	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Acetylaminofluorene (2-)
Certified	Yes	NJ	SHW07.04675	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Aminobiphenyl (4-)
Dropped	No	NJ	SHW07.04700	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C]	Benzyl chloride
Certified	Yes	NJ	SHW07.04702	NPW, SCM	GC/MS, Extract, or Direct Injection, Capillary	[SW-846 8270C] [SW-846 8270D]	Biphenyl (1,1'-)
Certified	Yes	NJ	SHW07.04705	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Chlorobenzilate
Certified	Yes	NJ	SHW07.04715	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Diallate (cis)
Certified	Yes	NJ	SHW07.04720	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Diallate (trans)
Certified	Yes	NJ	SHW07.04730	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Dibenz(a,h)acridine
Certified	Yes	NJ	SHW07.04755	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Dichlorophenol (2,6-)
Certified	Yes	NJ	SHW07.04760	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Dimethoate
Dropped	No	NJ	SHW07.04765	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270D]	Dimethylaminobenzene (N, N-)
Certified	Yes	NJ	SHW07.04767	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Dimethylaminoazobenzene
Certified	Yes	NJ	SHW07.04770	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Dimethylbenz(a)anthracene (7,12-)
Certified	Yes	NJ	SHW07.04780	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Dinitrobenzene (1,3-)
Certified	Yes	NJ	SHW07.04785	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Dinoseb

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Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: SHW07 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW07.04255	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloro-2-butene (trans-1,4-)
Certified	Yes	NJ	SHW07.04257	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Diisopropyl Ether [DIPE]
Certified	Yes	NJ	SHW07.04258	NPW, SCM	GC/MS, P&T, or Direct Injection, Capillary	[SW-846 8260B]	Butanol (1-)
Certified	Yes	NJ	SHW07.04259	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Ethanol
Certified	Yes	NJ	SHW07.04260	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Methylene chloride (Dichloromethane)
Certified	Yes	NJ	SHW07.04265	NPW, SCM	GC/MS, P&T, or Direct Injection, Capillary	[SW-846 8260B]	Nitropropane (2-)
Certified	Yes	NJ	SHW07.04270	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Tetrachloroethane (1,1,2,2-)
Certified	Yes	NJ	SHW07.04280	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Tetrachloroethene
Certified	Yes	NJ	SHW07.04282	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Tetrahydrofuran
Certified	Yes	NJ	SHW07.04290	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trichloroethane (1,1,1-)
Certified	Yes	NJ	SHW07.04300	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trichloroethane (1,1,2-)
Certified	Yes	NJ	SHW07.04310	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trichloroethene
Certified	Yes	NJ	SHW07.04320	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trichlorofluoromethane
Certified	Yes	NJ	SHW07.04322	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trichloro (1,1,2-) trifluoroethane (1,2,2-)
Certified	Yes	NJ	SHW07.04325	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trichloropropane (1,2,3-)
Certified	Yes	NJ	SHW07.04327	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Vinyl acetate
Certified	Yes	NJ	SHW07.04330	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Vinyl chloride
Certified	Yes	NJ	SHW07.04340	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Acetone
Certified	Yes	NJ	SHW07.04350	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Carbon disulfide
Certified	Yes	NJ	SHW07.04360	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Butanone (2-)
Certified	Yes	NJ	SHW07.04364	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Ethyl-tert-butyl Ether [ETBE]
Certified	Yes	NJ	SHW07.04365	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Ethyl acetate
Certified	Yes	NJ	SHW07.04367	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Ethyl methacrylate
Certified	Yes	NJ	SHW07.04370	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Hexanone (2-)
Certified	Yes	NJ	SHW07.04371	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Methacrylonitrile
Certified	Yes	NJ	SHW07.04372	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Methyl acrylate
Certified	Yes	NJ	SHW07.04373	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Methyl methacrylate
Certified	Yes	NJ	SHW07.04374	NPW, SCM	GC/MS, P&T, or Direct Injection, Capillary	[SW-846 8260B]	Methyl acetate
Certified	Yes	NJ	SHW07.04375	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Methyl iodide
Certified	Yes	NJ	SHW07.04376	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Iso-butyl alcohol
Certified	Yes	NJ	SHW07.04379	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Pentachloroethane
Certified	Yes	NJ	SHW07.04380	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Pentanone (4-methyl-2-) (MIBK)

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New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 02/24/2011 until 06/30/2011

Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: SHW07 – Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW07.04990	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Toluidine (5-nitro-2-)
Certified	Yes	NJ	SHW07.04995	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Trinitrobenzene (1,3,5-)
Certified	Yes	NJ	SHW07.05004	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	N-Nitrosodiethylamine
Certified	Yes	NJ	SHW07.05005	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	N-Nitrosodimethylamine
Certified	Yes	NJ	SHW07.05006	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	N-Nitroso-di-n-propylamine
Certified	Yes	NJ	SHW07.05010	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	N-Nitrosodiphenylamine
Certified	Yes	NJ	SHW07.05011	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	N-Nitrosomethylethylamine
Certified	Yes	NJ	SHW07.05012	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	N-Nitrosopyrrolidine
Certified	Yes	NJ	SHW07.05020	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Diphenylamine
Certified	Yes	NJ	SHW07.05030	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Carbazole
Certified	Yes	NJ	SHW07.05038	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Benzidine
Certified	Yes	NJ	SHW07.05040	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Dichlorobenzidine (3,3'-)
Certified	Yes	NJ	SHW07.05045	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Diphenylhydrazine (1,2-)
Certified	Yes	NJ	SHW07.05048	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Aniline
Certified	Yes	NJ	SHW07.05050	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Chloraniline (4-)
Certified	Yes	NJ	SHW07.05060	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Nitroaniline (2-)
Certified	Yes	NJ	SHW07.05062	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Nitroaniline (3-)
Certified	Yes	NJ	SHW07.05063	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Nitroaniline (4-)
Certified	Yes	NJ	SHW07.05070	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Chloronaphthalene (2-)
Certified	Yes	NJ	SHW07.05080	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Hexachlorobenzene
Certified	Yes	NJ	SHW07.05090	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Hexachlorobutadiene (1,3-)
Certified	Yes	NJ	SHW07.05100	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Hexachlorocyclopentadiene
Certified	Yes	NJ	SHW07.05110	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Hexachloroethane
Certified	Yes	NJ	SHW07.05115	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Hexachloropropene
Certified	Yes	NJ	SHW07.05120	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Trichlorobenzene (1,2,4-)
Certified	Yes	NJ	SHW07.05130	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Bis (2-chloroethoxy) methane
Certified	Yes	NJ	SHW07.05132	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Bis (2-chloroethyl) ether
Certified	Yes	NJ	SHW07.05140	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Bis (2-chloroisopropyl) ether
Certified	Yes	NJ	SHW07.05150	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Chlorophenyl-phenyl ether (4-)
Certified	Yes	NJ	SHW07.05160	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Bromophenyl-phenyl ether (4-)
Certified	Yes	NJ	SHW07.05170	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Dinitrotoluene (2,4-)
Certified	Yes	NJ	SHW07.05180	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Dinitrotoluene (2,6-)

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2235 RT 130
BLDG B
Dayton, NJ 08810

Category: SHW07 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW07.04790	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Disulfoton
Certified	Yes	NJ	SHW07.04810	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Isodrin
Certified	Yes	NJ	SHW07.04815	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Isosafrole (cis-)
Certified	Yes	NJ	SHW07.04820	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Isosafrole (trans-)
Certified	Yes	NJ	SHW07.04825	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Kepone
Certified	Yes	NJ	SHW07.04830	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Methanesulfonate (Ethyl-)
Certified	Yes	NJ	SHW07.04835	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Methanesulfonate (Methyl-)
Certified	Yes	NJ	SHW07.04845	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Methylcholanthrene (3-)
Certified	Yes	NJ	SHW07.04850	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Napthoquinone (1,4-)
Certified	Yes	NJ	SHW07.04855	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Napththylamine (1-)
Certified	Yes	NJ	SHW07.04860	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Napththylamine (2-)
Certified	Yes	NJ	SHW07.04870	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	N-Nitroso-di-n-butylamine
Certified	Yes	NJ	SHW07.04875	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	N-Nitrosomorpholine
Certified	Yes	NJ	SHW07.04880	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	N-Nitrosopiperidine
Certified	Yes	NJ	SHW07.04885	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Parathion
Certified	Yes	NJ	SHW07.04890	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Parathion methyl
Certified	Yes	NJ	SHW07 04895	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Pentachlorobenzene
Certified	Yes	NJ	SHW07.04900	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Pentachloroethane
Certified	Yes	NJ	SHW07.04905	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Pentachloronitrobenzene
Certified	Yes	NJ	SHW07.04910	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Phenacetin
Certified	Yes	NJ	SHW07.04920	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Phenylethylamine (alpha, alpha-Dimethyl)
Certified	Yes	NJ	SHW07.04925	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Phorate
Certified	Yes	NJ	SHW07.04930	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Phosphorothioate (O,O,O-triethyl)
Certified	Yes	NJ	SHW07.04935	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Phosphorothioate (O,O-diethyl-O-2-pyrazinyl) [Thionazin]
Certified	Yes	NJ	SHW07.04940	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Picoline (2-)
Certified	Yes	NJ	SHW07.04945	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Pronamide
Certified	Yes	NJ	SHW07.04950	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Quinoline -1-Oxide (4-Nitro)
Certified	Yes	NJ	SHW07.04955	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Safrole
Certified	Yes	NJ	SHW07.04975	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Tetrachlorobenzene (1,2,4,5-)
Certified	Yes	NJ	SHW07.04980	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Tetrachlorophenol (2,3,4,6-)
Certified	Yes	NJ	SHW07.04985	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Toluidine (2-) (2-Methylaniline)

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2235 RT 130
BLDG B
Dayton, NJ 08810

Category: SHW07 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW07.05190	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Isophorone
Certified	Yes	NJ	SHW07.05200	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Nitrobenzene
Certified	Yes	NJ	SHW07.05210	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Butyl benzyl phthalate
Certified	Yes	NJ	SHW07.05220	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Bis (2-ethylhexyl) phthalate
Certified	Yes	NJ	SHW07.05230	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Diethyl phthalate
Certified	Yes	NJ	SHW07.05240	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Dimethyl phthalate
Certified	Yes	NJ	SHW07.05250	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Di-n-butyl phthalate
Certified	Yes	NJ	SHW07.05260	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Di-n-octyl phthalate
Certified	Yes	NJ	SHW07.05270	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Acenaphthene
Certified	Yes	NJ	SHW07.05280	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Anthracene
Certified	Yes	NJ	SHW07.05290	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Acenaphthylene
Certified	Yes	NJ	SHW07.05300	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Benzo(a)anthracene
Certified	Yes	NJ	SHW07.05310	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Benzo(a)pyrene
Certified	Yes	NJ	SHW07.05320	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Benzo(b)fluoranthene
Certified	Yes	NJ	SHW07.05330	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Benzo(ghi)perylene
Certified	Yes	NJ	SHW07.05340	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Benzo(k)fluoranthene
Certified	Yes	NJ	SHW07.05350	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Chrysene
Certified	Yes	NJ	SHW07.05360	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Dibenzo(a,h)anthracene
Certified	Yes	NJ	SHW07.05370	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Fluoranthene
Certified	Yes	NJ	SHW07.05380	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Fluorene
Certified	Yes	NJ	SHW07.05390	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Indeno(1,2,3-cd)pyrene
Certified	Yes	NJ	SHW07.05400	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Methylnaphthalene (2-)
Certified	Yes	NJ	SHW07.05410	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Naphthalene
Certified	Yes	NJ	SHW07.05420	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Phenanthrene
Certified	Yes	NJ	SHW07.05430	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Pyrene
Certified	Yes	NJ	SHW07.05440	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Methyl phenol (4-chloro-3-)
Certified	Yes	NJ	SHW07.05450	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Chlorophenol (2-)
Certified	Yes	NJ	SHW07.05460	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Dichlorophenol (2,4-)
Certified	Yes	NJ	SHW07.05470	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Dimethylphenol (2,4-)
Certified	Yes	NJ	SHW07.05480	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Dinitrophenol (2,4-)
Certified	Yes	NJ	SHW07.05490	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Dinitrophenol (2-methyl-4,6-)
Certified	Yes	NJ	SHW07.05500	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Methylphenol (2-)

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Certified	Yes	NJ	SHW07.05510	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Methylphenol (4-)
Certified	Yes	NJ	SHW07.05520	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Nitrophenol (2-)
Certified	Yes	NJ	SHW07.05530	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Nitrophenol (4-)
Certified	Yes	NJ	SHW07.05540	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Pentachlorophenol
Certified	Yes	NJ	SHW07.05550	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Phenol
Certified	Yes	NJ	SHW07.05560	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Trichlorophenol (2,4,5-)
Certified	Yes	NJ	SHW07.05570	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Trichlorophenol (2,4,6-)
Certified	Yes	NJ	SHW07.05590	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Methylphenol (3-)
Certified	Yes	NJ	SHW07.05600	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Dibenzofuran
Certified	Yes	NJ	SHW07.05691	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Dichlorobenzene (1,2-)
Certified	Yes	NJ	SHW07.05692	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Dichlorobenzene (1,3-)
Certified	Yes	NJ	SHW07.05700	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Dichlorobenzene (1,4-)
Certified	Yes	NJ	SHW07.05705	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Benzaldehyde
Certified	Yes	NJ	SHW07.05710	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Benzoic acid
Certified	Yes	NJ	SHW07.05720	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Benzyl alcohol
Certified	Yes	NJ	SHW07.05725	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Decane (n-)
Certified	Yes	NJ	SHW07.05730	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Octadecane (n-)
Certified	Yes	NJ	SHW07.05750	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Pyridine
Certified	Yes	NJ	SHW07.05765	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Caprolactam
Certified	Yes	NJ	SHW07.05990	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Atrazine
Certified	Yes	NJ	SHW07.05995	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Hydroquinone
Certified	Yes	NJ	SHW07.07584	NPW, SCM	GC/MS/SIM, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Benzo(a)anthracene
Certified	Yes	NJ	SHW07.07586	NPW, SCM	GC/MS/SIM, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Benzo(a)pyrene
Certified	Yes	NJ	SHW07.07588	NPW, SCM	GC/MS/SIM, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Benzo(b)fluoranthene
Certified	Yes	NJ	SHW07.07590	NPW, SCM	GC/MS/SIM, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Benzo(k)fluoranthene
Certified	Yes	NJ	SHW07.07594	NPW, SCM	GC/MS/SIM, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Dibenzo(a,h)anthracene
Certified	Yes	NJ	SHW07.07596	NPW, SCM	GC/MS/SIM, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Hexachlorobenzene
Certified	Yes	NJ	SHW07.07598	NPW, SCM	GC/MS/SIM, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Indeno(1,2,3-cd)pyrene
Certified	Yes	NJ	SHW07.07616	NPW, SCM	GC/MS/SIM, Extract or Dir Inj, Capillary	[SW-846 8270C] [SW-846 8270D]	Pentachlorophenol

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New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 02/24/2011 until 06/30/2011

Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: SHW09 -- Miscellaneous Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW09.02000	NPW, SCM	Distillation	[SW-846 9010C]	Cyanide
Certified	Yes	NJ	SHW09.03000	NPW, SCM	Distillation	[SW-846 9010C]	Cyanide - amenable to Cl2
Certified	Yes	NJ	SHW09.05000	NPW, SCM	Colorimetric, Automated	[SW-846 9012B, Rev. 2, 11/04]	Cyanide
Certified	Yes	NJ	SHW09.10100	NPW, SCM	Titration	[SW-846 9034, Rev. 0, 12/96]	Sulfides, acid sol. & insol.
Certified	Yes	NJ	SHW09.13050	NPW, SCM	Ion Chromatography	[SW-846 9056] [SW-846 9056A]	Sulfate
Certified	Yes	NJ	SHW09.14000	NPW, SCM	Electrometric	[SW-846 9040C, Rev. 3, 11/04]	pH - waste, >20% water
Certified	Yes	NJ	SHW09.19000	NPW, SCM	Infrared Spectrometry or FID	[SW-846 9060A, Rev. 1, 11/04]	Total organic carbon (TOC)
Certified	Yes	NJ	SHW09.21000	NPW, SCM	Colorimetric, Man, 4AAP Distillation	[SW-846 9065, Rev. 0, 9/86]	Phenols
Certified	Yes	NJ	SHW09.24100	NPW, SCM	Extraction & Gravimetric - LL or SPE	[SW-846 1664A, Rev. 1, 2/99]	Oil & grease - hem
Certified	Yes	NJ	SHW09.30250	NPW, SCM	Ion Chromatography	[SW-846 9056] [SW-846 9056A]	Bromide
Certified	Yes	NJ	SHW09.33100	NPW, SCM	Ion Chromatography	[SW-846 9056] [SW-846 9056A]	Chloride
Certified	Yes	NJ	SHW09.34150	NPW, SCM	Ion Chromatography	[SW-846 9056] [SW-846 9056A]	Fluoride
Certified	No	NJ	SHW09.34160	NPW, SCM	Ion Chromatography	[USER DEFINED EPA 314 (Modified for solid matrices)]	Perchlorate

Category: SHW04 -- Inorganic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW04.03000	SCM	Acid Digestion, Soil Sediment & Sludge	[SW-846 3050B]	Metals
Certified	Yes	NJ	SHW04.03700	SCM	Chromium VI Digestion	[SW-846 3060A]	Metals
Certified	Yes	NJ	SHW04.33500	SCM	AA, Manual Cold Vapor	[SW-846 7471A] [SW-846 7471B]	Mercury - solid waste

Category: SHW05 -- Organic Parameters, Prep. / Screening

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW05.03000	SCM	Soxhlet Extraction	[SW-846 3540C]	Semivolatile organics
Certified	Yes	NJ	SHW05.04200	SCM	Pressurized Fluid Extraction	[SW-846 3545] [SW-846 3545A]	Semivolatile organics
Certified	Yes	NJ	SHW05.05000	SCM	Ultrasonic Extraction	[SW-846 3550B] [SW-846 3550C]	Semivolatile organics
Certified	Yes	NJ	SHW05.06000	SCM	Waste Dilution	[SW-846 3580A]	Organics
Certified	Yes	NJ	SHW05.07300	SCM	Closed System Purge & Trap	[SW-846 5035L]	Volatile organics - low conc.

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2235 RT 130
BLDG B
Dayton, NJ 08810

Category: SHW05 – Organic Parameters, Prep. / Screening

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW05.07310	SCM	Methanol Extract, Closed System P & T	[SW-846 5035H]	Volatile organics - high conc.
Certified	Yes	NJ	SHW05.10000	SCM	Cleanup-Alumina	[SW-846 3610B]	Semivolatile organics
Certified	Yes	NJ	SHW05.11000	SCM	Petroleum Waste, Cleanup Alumina	[SW-846 3611B]	Semivolatile organics
Certified	Yes	NJ	SHW05.12000	SCM	Cleanup-Florisil	[SW-846 3620B] [SW-846 3620C]	Semivolatile organics
Certified	Yes	NJ	SHW05.13000	SCM	Cleanup-Silica Gel	[SW-846 3630C, Rev. 3, 12/96]	Semivolatile organics
Certified	Yes	NJ	SHW05.14000	SCM	Cleanup-Gel Permeation	[SW-846 3640A, Rev. 1, 9/94]	Semivolatile organics
Certified	Yes	NJ	SHW05.15000	SCM	Cleanup-Acid/Base Partition	[SW-846 3650B, Rev. 2, 12/96]	Semivolatile organics
Certified	Yes	NJ	SHW05.16000	SCM	Cleanup-Sulfur Removal	[SW-846 3660B, Rev. 2, 12/96]	Semivolatile organics
Certified	Yes	NJ	SHW05.17000	SCM	Cleanup-Sulfuric Acid/KMnO4	[SW-846 3665A, Rev. 1, 12/96]	Semivolatile organics
Certified	Yes	NJ	SHW05.18000	SCM	Headspace, GC or GC/MS Screen	[SW-846 3810, Rev. 0, 9/86]	Volatile organics

Category: SHW09 – Miscellaneous Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW09.08100	SCM	Extraction	[SW-846 9023, Rev. 0, 12/96]	Extractable organic halides (EOX)
Certified	Yes	NJ	SHW09.16000	SCM	Mix with Water or Calcium Chloride	[SW-846 9045C, Rev. 3, 1/95]	pH - soil and waste
Applied	No	NJ	SHW09.19100	SCM	Pyrolytic	[OTHER Lloyd Kahn]	Total organic carbon (TOC)
Certified	Yes	NJ	SHW09.25000	SCM	Extraction & Gravimetric	[SW-846 9071 B, Rev. 2, 5/99]	Oil & grease - sludge-hem
Certified	Yes	NJ	SHW09.26100	SCM	Combustion, Bomb Oxidation	[SW-846 5050, Rev. 0, 9/94]	Chlorine - total, solid waste
Certified	Yes	NJ	SHW09.28350	SCM	Bomb Calorimeter	[ASTM D-240]	Heat of combustion (BTU)
Certified	Yes	NJ	SHW09.29000	SCM	Flow-Through Paint Filter, Observation	[SW-846 9095, Rev. 0, 9/86]	Free liquid

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New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 02/24/2011 until 06/30/2011

Laboratory Name: ACCUTEST LABORATORIES Laboratory Number: 12129 Activity ID: NLC100009
2235 RT 130
BLDG B
Dayton, NJ 08810

Category: SHW09 – Miscellaneous Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW09.40000	SCM	Soils, Sodium Acetate	[SW-846 9081, Rev. 0, 9/86]	Cation-exchange capacity

Joseph F. Aiello, Chief

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State of New Jersey
Department of Environmental Protection

Certifies That

Alpha Analytical

Laboratory Certification ID # MA015

is hereby approved as a

Nationally Accredited Environmental Laboratory

to perform the analyses as indicated on the Annual Certified Parameter List which must accompany this certificate to be valid

having duly met the requirements of the

Regulations Governing The Certification Of Laboratories And Environmental Measurements N.J.A.C. 7:18 et. seq.

and

having been found compliant with the standards approved by the

The NELAC Institute

Expiration Date June 30, 2011

NJDEP is a NELAP Recognized Accreditation Body

Joseph F. Aiello, Chief
Office of Quality Assurance

This certificate is to be conspicuously displayed at the laboratory with the annual certified parameter list in a location on the premises visible to the public.
Consumers are urged to verify the laboratory's current accreditation status with the State of NJ, NELAP.

R2-0000919

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 01/03/2011 until 06/30/2011

Laboratory Name: ALPHA ANALYTICAL Laboratory Number: MA015 Activity ID: NLC100003
320 FORBES BLVD
MANSFIELD, MA 02048

Category: CAP03 -- Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CAP03.00180	AE	GC/MS, Canisters	[EPA TO-15]	Acetaldehyde
Certified	Yes	NJ	CAP03.00184	AE	GC/MS, Canisters	[EPA TO-15]	Acetone
Certified	Yes	NJ	CAP03.00185	AE	GC/MS, Canisters	[EPA TO-15]	Acetonitrile
Certified	Yes	NJ	CAP03.00195	AE	GC/MS, Canisters	[EPA TO-15]	Acrolein
Certified	Yes	NJ	CAP03.00210	AE	GC/MS, Canisters	[EPA TO-15]	Acrylonitrile
Certified	Yes	NJ	CAP03.00215	AE	GC/MS, Canisters	[EPA TO-15]	Allyl chloride
Certified	Yes	NJ	CAP03.00225	AE	GC/MS, Canisters	[EPA TO-15]	Benzene
Certified	Yes	NJ	CAP03.00230	AE	GC/MS, Canisters	[EPA TO-15]	Benzyl chloride
Certified	Yes	NJ	CAP03.00250	AE	GC/MS, Canisters	[EPA TO-15]	Bromodichloromethane
Certified	Yes	NJ	CAP03.00255	AE	GC/MS, Canisters	[EPA TO-15]	Bromoform
Certified	Yes	NJ	CAP03.00260	AE	GC/MS, Canisters	[EPA TO-15]	Bromomethane
Certified	Yes	NJ	CAP03.00265	AE	GC/MS, Canisters	[EPA TO-15]	Butadiene (1,3-)
Certified	Yes	NJ	CAP03.00270	AE	GC/MS, Canisters	[EPA TO-15]	Carbon disulfide
Certified	Yes	NJ	CAP03.00275	AE	GC/MS, Canisters	[EPA TO-15]	Carbon tetrachloride
Certified	Yes	NJ	CAP03.00300	AE	GC/MS, Canisters	[EPA TO-15]	Chlorobenzene
Certified	Yes	NJ	CAP03.00305	AE	GC/MS, Canisters	[EPA TO-15]	Chloroethane
Certified	Yes	NJ	CAP03.00310	AE	GC/MS, Canisters	[EPA TO-15]	Chloroform
Certified	Yes	NJ	CAP03.00315	AE	GC/MS, Canisters	[EPA TO-15]	Chloromethane
Certified	Yes	NJ	CAP03.00325	AE	GC/MS, Canisters	[EPA TO-15]	Chlorotoluene (2-)
Certified	Yes	NJ	CAP03.00335	AE	GC/MS, Canisters	[EPA TO-15]	Cyclohexane
Certified	Yes	NJ	CAP03.00342	AE	GC/MS, Canisters	[EPA TO-15]	Dibromochloromethane
Certified	Yes	NJ	CAP03.00345	AE	GC/MS, Canisters	[EPA TO-15]	Dibromo-3-chloropropane (1,2-)
Certified	Yes	NJ	CAP03.00350	AE	GC/MS, Canisters	[EPA TO-15]	Dibromoethane (1,2-) (EDB)
Certified	Yes	NJ	CAP03.00355	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorobenzene (1,2-)
Certified	Yes	NJ	CAP03.00360	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorobenzene (1,3-)
Certified	Yes	NJ	CAP03.00365	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorobenzene (1,4-)
Certified	Yes	NJ	CAP03.00368	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorodifluoromethane
Certified	Yes	NJ	CAP03.00370	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethane (1,1-)
Certified	Yes	NJ	CAP03.00375	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethane (1,2-)
Certified	Yes	NJ	CAP03.00380	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethene (1,1-)
Certified	Yes	NJ	CAP03.00384	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethene (cis-1,2-)

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New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 01/03/2011 until 06/30/2011

Laboratory Name: ALPHA ANALYTICAL Laboratory Number: MA015 Activity ID: NLC100003
320 FORBES BLVD
MANSFIELD, MA 02048

Category: CAP03 – Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CAP03.00385	AE	GC/MS, Canisters	[EPA TO-15]	Dichloroethene (trans-1,2-)
Certified	Yes	NJ	CAP03.00390	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorofluoromethane
Certified	Yes	NJ	CAP03.00395	AE	GC/MS, Canisters	[EPA TO-15]	Dichloropropane (1,2-)
Certified	Yes	NJ	CAP03.00400	AE	GC/MS, Canisters	[EPA TO-15]	Dichloropropene (cis-1,3-)
Certified	Yes	NJ	CAP03.00401	AE	GC/MS, Canisters	[EPA TO-15]	Dichloropropene (trans-1,3-)
Certified	Yes	NJ	CAP03.00405	AE	GC/MS, Canisters	[EPA TO-15]	Dichlorotetrafluoroethane (1,2-)
Certified	Yes	NJ	CAP03.00440	AE	GC/MS, Canisters	[EPA TO-15]	Dioxane (1,4-)
Certified	Yes	NJ	CAP03.00451	AE	GC/MS, Canisters	[EPA TO-15]	Ethanol
Certified	Yes	NJ	CAP03.00452	AE	GC/MS, Canisters	[EPA TO-15]	Ethyl acetate
Certified	Yes	NJ	CAP03.00465	AE	GC/MS, Canisters	[EPA TO-15]	Ethylbenzene
Certified	Yes	NJ	CAP03.00480	AE	GC/MS, Canisters	[EPA TO-15]	Ethyltoluene (4-)
Certified	Yes	NJ	CAP03.00490	AE	GC/MS, Canisters	[EPA TO-15]	Hexachlorobutadiene (1,3-)
Certified	Yes	NJ	CAP03.00498	AE	GC/MS, Canisters	[EPA TO-15]	Hexanone (2-)
Certified	Yes	NJ	CAP03.00500	AE	GC/MS, Canisters	[EPA TO-15]	Heptane (n-)
Certified	Yes	NJ	CAP03.00505	AE	GC/MS, Canisters	[EPA TO-15]	Hexane (n-)
Certified	Yes	NJ	CAP03.00511	AE	GC/MS, Canisters	[EPA TO-15]	Isopropanol
Certified	Yes	NJ	CAP03.00515	AE	GC/MS, Canisters	[EPA TO-15]	Isopropylbenzene
Certified	Yes	NJ	CAP03.00520	AE	GC/MS, Canisters	[EPA TO-15]	Methyl alcohol (Methanol)
Certified	Yes	NJ	CAP03.00525	AE	GC/MS, Canisters	[EPA TO-15]	Methyl ethyl ketone
Certified	Yes	NJ	CAP03.00535	AE	GC/MS, Canisters	[EPA TO-15]	Methyl isobutyl ketone (MIBK)
Certified	Yes	NJ	CAP03.00550	AE	GC/MS, Canisters	[EPA TO-15]	Methyl tert-butyl ether
Certified	Yes	NJ	CAP03.00555	AE	GC/MS, Canisters	[EPA TO-15]	Methylene chloride (Dichloromethane)
Certified	Yes	NJ	CAP03.00567	AE	GC/MS, Canisters	[EPA TO-15]	Naphthalene
Certified	Yes	NJ	CAP03.00612	AE	GC/MS, Canisters	[EPA TO-15]	Propylene
Certified	Yes	NJ	CAP03.00625	AE	GC/MS, Canisters	[EPA TO-15]	Styrene
Certified	Yes	NJ	CAP03.00635	AE	GC/MS, Canisters	[EPA TO-15]	Trichlorobenzene (1,2,4-)
Certified	Yes	NJ	CAP03.00640	AE	GC/MS, Canisters	[EPA TO-15]	Trimethylbenzene (1,3,5-)
Certified	Yes	NJ	CAP03.00645	AE	GC/MS, Canisters	[EPA TO-15]	Trimethylbenzene (1,2,4-)
Certified	Yes	NJ	CAP03.00650	AE	GC/MS, Canisters	[EPA TO-15]	Trimethylpentane (2,2,4-)
Certified	Yes	NJ	CAP03.00652	AE	GC/MS, Canisters	[EPA TO-15]	Tert-butyl alcohol
Certified	Yes	NJ	CAP03.00655	AE	GC/MS, Canisters	[EPA TO-15]	Tetrachloroethane (1,1,2,2-)
Certified	Yes	NJ	CAP03.00660	AE	GC/MS, Canisters	[EPA TO-15]	Tetrachloroethene

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320 FORBES BLVD
MANSFIELD, MA 02048

Category: CAP03 – Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	CAP03.00662	AE	GC/MS, Canisters	[EPA TO-15]	Tetrahydrofuran
Certified	Yes	NJ	CAP03.00665	AE	GC/MS, Canisters	[EPA TO-15]	Toluene
Certified	Yes	NJ	CAP03.00670	AE	GC/MS, Canisters	[EPA TO-15]	Trichloroethane (1,1,1-)
Certified	Yes	NJ	CAP03.00675	AE	GC/MS, Canisters	[EPA TO-15]	Trichloroethane (1,1,2-)
Certified	Yes	NJ	CAP03.00680	AE	GC/MS, Canisters	[EPA TO-15]	Trichloroethene
Certified	Yes	NJ	CAP03.00684	AE	GC/MS, Canisters	[EPA TO-15]	Trichlorofluoromethane
Certified	Yes	NJ	CAP03.00685	AE	GC/MS, Canisters	[EPA TO-15]	Trichloro (1,1,2-) trifluoroethane (1,2,2-)
Certified	Yes	NJ	CAP03.00700	AE	GC/MS, Canisters	[EPA TO-15]	Vinyl acetate
Certified	Yes	NJ	CAP03.00705	AE	GC/MS, Canisters	[EPA TO-15]	Vinyl bromide
Certified	Yes	NJ	CAP03.00710	AE	GC/MS, Canisters	[EPA TO-15]	Vinyl chloride
Certified	Yes	NJ	CAP03.00715	AE	GC/MS, Canisters	[EPA TO-15]	Xylene (m-)
Certified	Yes	NJ	CAP03.00720	AE	GC/MS, Canisters	[EPA TO-15]	Xylene (o-)
Certified	Yes	NJ	CAP03.00725	AE	GC/MS, Canisters	[EPA TO-15]	Xylene (p-)
Certified	Yes	NJ	CAP03.00730	AE	GC/MS, Canisters	[EPA TO-15]	Xylenes (total)
Applied	No	NJ	CAP03.06850	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Acetone
Applied	No	NJ	CAP03.06852	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Allyl chloride
Applied	No	NJ	CAP03.06854	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Benzene
Applied	No	NJ	CAP03.06856	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Bromodichloromethane
Applied	No	NJ	CAP03.06858	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Bromoform
Applied	No	NJ	CAP03.06860	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Bromomethane
Applied	No	NJ	CAP03.06862	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Butadiene (1,3-)
Applied	No	NJ	CAP03.06864	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Carbon disulfide
Applied	No	NJ	CAP03.06866	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Carbon tetrachloride
Applied	No	NJ	CAP03.06868	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Chlorobenzene
Applied	No	NJ	CAP03.06870	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Chloroethane
Applied	No	NJ	CAP03.06872	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Chloroform
Applied	No	NJ	CAP03.06874	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Chloromethane
Applied	No	NJ	CAP03.06876	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Chlorotoluene (2-)
Applied	No	NJ	CAP03.06878	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Cyclohexane
Applied	No	NJ	CAP03.06880	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dibromochloromethane
Applied	No	NJ	CAP03.06882	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dibromoethane (1,2-) (EDB)
Applied	No	NJ	CAP03.06884	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichlorobenzene (1,2-)

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New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 01/03/2011 until 06/30/2011

Laboratory Name: ALPHA ANALYTICAL Laboratory Number: MA015 Activity ID: NLC100003
320 FORBES BLVD
MANSFIELD, MA 02048

Category: CAP03 – Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Applied	No	NJ	CAP03.06886	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichlorobenzene (1,3-)
Applied	No	NJ	CAP03.06888	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichlorobenzene (1,4-)
Applied	No	NJ	CAP03.06890	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichlorodifluoromethane
Applied	No	NJ	CAP03.06892	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichloroethane (1,1-)
Applied	No	NJ	CAP03.06894	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichloroethane (1,2-)
Applied	No	NJ	CAP03.06896	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichloroethene (1,1-)
Applied	No	NJ	CAP03.06898	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichloroethene (cis-1,2-)
Applied	No	NJ	CAP03.06900	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichloroethene (trans-1,2-)
Applied	No	NJ	CAP03.06902	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichloropropane (1,2-)
Applied	No	NJ	CAP03.06904	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichloropropene (cis-1,3-)
Applied	No	NJ	CAP03.06906	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichloropropene (trans-1,3-)
Applied	No	NJ	CAP03.06908	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dichlorotetrafluoroethane (1,2-)
Applied	No	NJ	CAP03.06910	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Dioxane (1,4-)
Applied	No	NJ	CAP03.06912	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Ethanol
Applied	No	NJ	CAP03.06914	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Ethylbenzene
Applied	No	NJ	CAP03.06916	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Ethyltoluene (4-)
Applied	No	NJ	CAP03.06918	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Heptane (n-)
Applied	No	NJ	CAP03.06920	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Hexachlorobutadiene (1,3-)
Applied	No	NJ	CAP03.06922	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Hexane (n-)
Applied	No	NJ	CAP03.06924	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Isopropanol
Applied	No	NJ	CAP03.06926	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Methylene chloride (Dichloromethane)
Applied	No	NJ	CAP03.06928	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Methyl ethyl ketone
Applied	No	NJ	CAP03.06930	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Methyl isobutyl ketone (MIBK)
Applied	No	NJ	CAP03.06932	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Methyl methacrylate
Applied	No	NJ	CAP03.06934	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Methyl tert-butyl ether
Applied	No	NJ	CAP03.06936	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Styrene
Applied	No	NJ	CAP03.06938	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Tert-butyl alcohol
Applied	No	NJ	CAP03.06940	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Tetrachloroethane (1,1,2,2-)
Applied	No	NJ	CAP03.06942	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Tetrachloroethene
Applied	No	NJ	CAP03.06944	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Tetrahydrofuran
Applied	No	NJ	CAP03.06946	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Toluene
Applied	No	NJ	CAP03.06948	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trichlorobenzene (1,2,4-)

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320 FORBES BLVD
MANSFIELD, MA 02048

Category: CAP03 -- Atmospheric Organic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Applied	No	NJ	CAP03.06950	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trichloroethane (1,1,1-)
Applied	No	NJ	CAP03.06952	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trichloroethane (1,1,2-)
Applied	No	NJ	CAP03.06954	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trichloroethene
Applied	No	NJ	CAP03.06956	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trichlorofluoromethane
Applied	No	NJ	CAP03.06958	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trichloro (1,1,2-) trifluoroethane (1,2,2-)
Applied	No	NJ	CAP03.06960	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trimethylbenzene (1,2,4-)
Applied	No	NJ	CAP03.06962	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trimethylbenzene (1,3,5-)
Applied	No	NJ	CAP03.06964	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Trimethylpentane (2,2,4-)
Applied	No	NJ	CAP03.06966	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Vinyl bromide
Applied	No	NJ	CAP03.06968	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Vinyl chloride
Applied	No	NJ	CAP03.06970	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Xylene (m- + p-)
Applied	No	NJ	CAP03.06972	AE	GC/MS, Canisters	[OTHER NJDEP-LLTO-15-3/2009]	Xylene (o-)

Category: SHW04 -- Inorganic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	SHW04.47105	BT	ICP/MS	[SW-846 6020]	Tin

Category: SHW05 -- Organic Parameters, Prep. / Screening

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Applied	No	LA	SHW05.10000	BT	Cleanup-Alumina	[SW-846 3610B, Rev. 3, 12/96]	Semivolatile organics

Category: SHW07 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	SHW07.04702	BT	GC/MS, Extract, or Direct Injection, Capillary	[SW-846 8270C]	Biphenyl (1,1'-)

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320 FORBES BLVD
MANSFIELD, MA 02048

Category: SHW04 -- Inorganic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	SHW04.44001	BT, NPW	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Strontium
Certified	Yes	LA	SHW04.05500	BT, NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Aluminum
Certified	Yes	LA	SHW04.07000	BT, NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Antimony
Certified	Yes	LA	SHW04.09500	BT, NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Arsenic
Certified	Yes	LA	SHW04.12000	BT, NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Barium
Certified	Yes	LA	SHW04.14000	BT, NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Beryllium
Certified	Yes	LA	SHW04.16000	BT, NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Cadmium
Certified	Yes	LA	SHW04.17505	BT, NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Calcium
Certified	Yes	LA	SHW04.19000	BT, NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Chromium
Certified	Yes	LA	SHW04.23000	BT, NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Cobalt
Certified	Yes	LA	SHW04.25000	BT, NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Copper
Certified	Yes	LA	SHW04.26005	BT, NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Iron
Certified	Yes	LA	SHW04.30505	BT, NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Magnesium
Certified	Yes	LA	SHW04.31600	BT, NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Manganese
Certified	Yes	LA	SHW04.34005	BT, NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Molybdenum
Certified	Yes	LA	SHW04.36000	BT, NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 7/92]	Nickel
Certified	Yes	LA	SHW04.38505	BT, NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Potassium
Certified	Yes	LA	SHW04.40600	BT, NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Selenium
Certified	Yes	LA	SHW04.41500	BT, NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Silver
Certified	Yes	LA	SHW04.45500	BT, NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Thallium
Certified	Yes	LA	SHW04.47505	BT, NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Vanadium
Certified	Yes	LA	SHW04.49500	BT, NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Zinc

Category: SHW05 -- Organic Parameters, Prep. / Screening

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	SHW05.01000	BT, NPW, SCM	Separatory Funnel Extraction	[SW-846 3510C, Rev. 3, 12/96]	Semivolatile organics
Certified	Yes	LA	SHW05.13000	BT, NPW, SCM	Cleanup-Silica Gel	[SW-846 3630C, Rev. 3, 12/96]	Semivolatile organics
Certified	Yes	LA	SHW05.14000	BT, NPW, SCM	Cleanup-Gel Permeation	[SW-846 3640A, Rev. 1, 9/94]	Semivolatile organics

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320 FORBES BLVD
MANSFIELD, MA 02048

Category: SHW07 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	SHW07.05070	BT, NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Chloronaphthalene (2-)
Certified	Yes	LA	SHW07.05270	BT, NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Acenaphthene
Certified	Yes	LA	SHW07.05280	BT, NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Anthracene
Certified	Yes	LA	SHW07.05290	BT, NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Acenaphthylene
Certified	Yes	LA	SHW07.05300	BT, NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Benzo(a)anthracene
Certified	Yes	LA	SHW07.05310	BT, NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Benzo(a)pyrene
Certified	Yes	LA	SHW07.05320	BT, NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Benzo(b)fluoranthene
Certified	Yes	LA	SHW07.05330	BT, NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Benzo(ghi)perylene
Certified	Yes	LA	SHW07.05340	BT, NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Benzo(k)fluoranthene
Certified	Yes	LA	SHW07.05350	BT, NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Chrysene
Certified	Yes	LA	SHW07.05360	BT, NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dibenzo(a,h)anthracene
Certified	Yes	LA	SHW07.05370	BT, NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Fluoranthene
Certified	Yes	LA	SHW07.05380	BT, NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Fluorene
Certified	Yes	LA	SHW07.05390	BT, NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Indeno(1,2,3-cd)pyrene
Certified	Yes	LA	SHW07.05400	BT, NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Methylnaphthalene (2-)
Certified	Yes	LA	SHW07.05410	BT, NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Naphthalene
Certified	Yes	LA	SHW07.05420	BT, NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Phenanthrene
Certified	Yes	LA	SHW07.05430	BT, NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Pyrene
Certified	Yes	LA	SHW07.05600	BT, NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dibenzofuran

Category: SHW05 -- Organic Parameters, Prep. / Screening

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	SHW05.05220	BT, SCM	Microscale Solvent Extraction - Solids	[SW-846 3570]	Semivolatile organics

Category: SHW04 -- Inorganic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	SHW04.01500	NPW	Acid Digestion/Aqueous Samples, ICP, FLAA	[SW-846 3010A, Rev. 1, 7/92]	Metals, Total

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Category: SHW04 -- Inorganic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	SHW04.02000	NPW	Acid Digestion For GFAA, Aqueous	[SW-846 3020A, Rev. 1, 7/92]	Metals
Certified	Yes	LA	SHW04.02100	NPW	Acid Digestion For GFAA, Micro asst Aqueous	[SW-846 3015, Rev. 0, 9/94]	Metals
Certified	Yes	LA	SHW04.15101	NPW	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Boron

Category: SHW05 -- Organic Parameters, Prep. / Screening

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Applied	No	LA	SHW05.02000	NPW	Continuous Liquid-Liquid Extraction	[SW-846 3520C, Rev. 3, 12/96]	Semivolatile organics

Category: SHW07 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	SHW07.04087	NPW	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B]	tert-Amylmethyl ether [TAME]
Certified	Yes	LA	SHW07.04187	NPW	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B]	Dibromo-3-chloropropane (1,2-)
Certified	Yes	LA	SHW07.04322	NPW	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B]	Trichloro (1,1,2-) trifluoroethane (1,2,2-)
Certified	Yes	LA	SHW07.04372	NPW	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B]	Methyl acrylate

Category: WPP02 -- Inorg. Parameters, Nutrients and Demands

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	WPP02.01500	NPW	Electrometric or Color Titration	[SM 2320 B]	Alkalinity as CaCO3
Certified	Yes	LA	WPP02.08050	NPW	ICP/MS	[EPA 200.8]	Calcium
Certified	Yes	LA	WPP02.24050	NPW	ICP/MS	[EPA 200.8]	Magnesium
Certified	Yes	LA	WPP02.36550	NPW	ICP/MS	[EPA 200.8]	Potassium
Certified	Yes	LA	WPP02.39000	NPW	Gravimetric, 103-105 Degrees C, Post Washing	[SM 2540 D]	Residue - nonfilterable (TSS)
Certified	Yes	LA	WPP02.40100	NPW	Gravimetric, 500 Degrees C	[SM 2540 G]	Total, fixed, and volatile solids (SQAR)
Certified	Yes	LA	WPP02.44050	NPW	ICP/MS	[EPA 200.8]	Sodium
Certified	Yes	LA	WPP02.45500	NPW	Wheatstone Bridge	[EPA 120.1] [SM 2510 B]	Specific conductance

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Category: WPP02 -- Inorg. Parameters, Nutrients and Demands

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	WPP02.50000	NPW	Nephelometric	[EPA 180.1]	Turbidity

Category: WPP04 -- Inorganic Parameters, Metals

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	WPP04.02100	NPW	ICP/MS	[EPA 200.8]	Aluminum
Certified	Yes	LA	WPP04.04600	NPW	ICP/MS	[EPA 200.8]	Antimony
Certified	Yes	LA	WPP04.05700	NPW	ICP/MS	[EPA 200.8]	Arsenic
Certified	Yes	LA	WPP04.08200	NPW	ICP/MS	[EPA 200.8]	Barium
Certified	Yes	LA	WPP04.11100	NPW	ICP/MS	[EPA 200.8]	Beryllium
Certified	Yes	LA	WPP04.13600	NPW	ICP/MS	[EPA 200.8]	Cadmium
Certified	Yes	LA	WPP04.18100	NPW	ICP/MS	[EPA 200.8]	Chromium
Certified	Yes	LA	WPP04.19600	NPW	ICP/MS	[EPA 200.8]	Cobalt
Certified	Yes	LA	WPP04.21600	NPW	ICP/MS	[EPA 200.8]	Copper
Certified	Yes	LA	WPP04.26550	NPW	ICP/MS	[EPA 200.8]	Iron
Certified	Yes	LA	WPP04.28100	NPW	ICP/MS	[EPA 200.8]	Lead
Certified	Yes	LA	WPP04.31100	NPW	ICP/MS	[EPA 200.8]	Manganese
Certified	Yes	LA	WPP04.33000	NPW	Manual Cold Vapor	[EPA 245.1]	Mercury
Certified	Yes	LA	WPP04.33200	NPW	Purge & Trap Atomic Fluorescence	[EPA 1631E]	Mercury
Certified	Yes	LA	WPP04.35200	NPW	ICP/MS	[EPA 200.8]	Molybdenum
Certified	Yes	LA	WPP04.37600	NPW	ICP/MS	[EPA 200.8]	Nickel
Certified	Yes	LA	WPP04.45600	NPW	ICP/MS	[EPA 200.8]	Selenium
Certified	Yes	LA	WPP04.48200	NPW	ICP/MS	[EPA 200.8]	Silver
Certified	Yes	LA	WPP04.50100	NPW	ICP/MS	[EPA 200.8]	Thallium
Certified	Yes	LA	WPP04.51200	NPW	ICP/MS	[EPA 200.8]	Tin
Certified	Yes	LA	WPP04.54100	NPW	ICP/MS	[EPA 200.8]	Vanadium
Certified	Yes	LA	WPP04.56600	NPW	ICP/MS	[EPA 200.8]	Zinc

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Category: SHW02 -- Characteristics of Hazardous Waste

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	SHW02.03000	NPW, SCM	Aqueous Waste, Potentiometric	[SW-846 9040B, Rev. 2, 1/95]	Corrosivity - pH waste, >20% water
Certified	Yes	NJ	SHW02.08000	NPW, SCM	Synthetic PPT Leachate Procedure	[SW-846 1312]	Metals - organics

Category: SHW04 -- Inorganic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	SHW04.28000	NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Lead
Certified	Yes	LA	SHW04.43005	NPW, SCM	ICP/MS	[SW-846 6020, Rev. 0, 9/94]	Sodium

Category: SHW05 -- Organic Parameters, Prep. / Screening

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	SHW05.06000	NPW, SCM	Waste Dilution	[SW-846 3580A, Rev. 1, 7/92]	Organics
Certified	Yes	LA	SHW05.07000	NPW, SCM	Purge & Trap Aqueous	[SW-846 5030B, Rev. 2, 12/96]	Volatile organics
Certified	Yes	LA	SHW05.07300	NPW, SCM	Closed System Purge & Trap	[SW-846 5035L, Rev. 0, 12/96]	Volatile organics - low conc.
Certified	Yes	LA	SHW05.07310	NPW, SCM	Methanol Extract, Closed System P & T	[SW-846 5035H, Rev. 0, 12/96]	Volatile organics - high conc.
Certified	Yes	LA	SHW05.16000	NPW, SCM	Cleanup-Sulfur Removal	[SW-846 3660B, Rev. 2, 12/96]	Semivolatile organics
Certified	Yes	LA	SHW05.17000	NPW, SCM	Cleanup-Sulfuric Acid/KMnO4	[SW-846 3665A, Rev. 1, 12/96]	Semivolatile organics

Category: SHW06 -- Organic Parameters, Chromatography

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	SHW06.04500	NPW, SCM	Extraction, GC, FID	[SW-846 8015B, Rev. 2, 12/96]	Diesel range organic
Certified	Yes	LA	SHW06.12010	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Aldrin
Certified	Yes	LA	SHW06.12020	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Alpha BHC
Certified	Yes	LA	SHW06.12030	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Beta BHC
Certified	Yes	LA	SHW06.12040	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Delta BHC
Certified	Yes	LA	SHW06.12050	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Lindane (gamma BHC)

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 01/03/2011 until 06/30/2011

Laboratory Name: ALPHA ANALYTICAL Laboratory Number: MA015 Activity ID: NLC100003
320 FORBES BLVD
MANSFIELD, MA 02048

Category: SHW06 -- Organic Parameters, Chromatography

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	SHW06.12060	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Chlordane (technical)
Certified	Yes	LA	SHW06.12070	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Chlordane (alpha)
Certified	Yes	LA	SHW06.12080	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Chlordane (gamma)
Certified	Yes	LA	SHW06.12090	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	DDD (4,4'-)
Certified	Yes	LA	SHW06.12100	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	DDE (4,4'-)
Certified	Yes	LA	SHW06.12110	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	DDT (4,4'-)
Certified	Yes	LA	SHW06.12120	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Dieldrin
Certified	Yes	LA	SHW06.12130	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Endosulfan I
Certified	Yes	LA	SHW06.12140	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Endosulfan II
Certified	Yes	LA	SHW06.12150	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Endosulfan sulfate
Certified	Yes	LA	SHW06.12160	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Endrin
Certified	Yes	LA	SHW06.12170	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Endrin aldehyde
Certified	Yes	LA	SHW06.12180	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Endrin ketone
Certified	Yes	LA	SHW06.12190	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Heptachlor
Certified	Yes	LA	SHW06.12200	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Heptachlor epoxide
Certified	Yes	LA	SHW06.12210	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Methoxychlor
Certified	Yes	LA	SHW06.12220	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8081A, Rev. 1, 12/96]	Toxaphene
Certified	Yes	LA	SHW06.13110	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8082, Rev. 0, 12/96]	PCB 1016
Certified	Yes	LA	SHW06.13120	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8082, Rev. 0, 12/96]	PCB 1221
Certified	Yes	LA	SHW06.13130	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8082, Rev. 0, 12/96]	PCB 1232
Certified	Yes	LA	SHW06.13140	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8082, Rev. 0, 12/96]	PCB 1242
Certified	Yes	LA	SHW06.13150	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8082, Rev. 0, 12/96]	PCB 1248
Certified	Yes	LA	SHW06.13160	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8082, Rev. 0, 12/96]	PCB 1254
Certified	Yes	LA	SHW06.13170	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8082, Rev. 0, 12/96]	PCB 1260
Certified	Yes	LA	SHW06.13200	NPW, SCM	GC, Extraction, ECD or HECD, Capillary	[SW-846 8082, Rev. 0, 12/96]	PCB Congeners (19)

Category: SHW07 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	SHW07.04010	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Benzene

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320 FORBES BLVD
MANSFIELD, MA 02048

Category: SHW07 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	SHW07.04011	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Bromobenzene
Certified	Yes	LA	SHW07.04012	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Butyl benzene (n-)
Certified	Yes	LA	SHW07.04013	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Sec-butylbenzene
Certified	Yes	LA	SHW07.04014	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Tert-butylbenzene
Certified	Yes	LA	SHW07.04020	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Chlorobenzene
Certified	Yes	LA	SHW07.04022	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B]	Chlorotoluene (2-)
Certified	Yes	LA	SHW07.04023	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B]	Chlorotoluene (4-)
Certified	Yes	LA	SHW07.04030	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichlorobenzene (1,2-)
Certified	Yes	LA	SHW07.04040	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichlorobenzene (1,3-)
Certified	Yes	LA	SHW07.04050	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichlorobenzene (1,4-)
Certified	Yes	LA	SHW07.04060	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Ethylbenzene
Certified	Yes	LA	SHW07.04065	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Isopropylbenzene
Certified	Yes	LA	SHW07.04067	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Propylbenzene (n-)
Certified	Yes	LA	SHW07.04070	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Toluene
Certified	Yes	LA	SHW07.04071	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Isopropyltoluene (4-)
Certified	Yes	LA	SHW07.04072	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trichlorobenzene (1,2,3-)
Certified	Yes	LA	SHW07.04073	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trimethylbenzene (1,2,4-)
Certified	Yes	LA	SHW07.04074	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trimethylbenzene (1,3,5-)
Certified	Yes	LA	SHW07.04080	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Xylenes (total)
Certified	Yes	LA	SHW07.04088	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Allyl chloride
Certified	Yes	LA	SHW07.04089	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Bromochloromethane
Certified	Yes	LA	SHW07.04090	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Bromodichloromethane
Certified	Yes	LA	SHW07.04100	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Bromoform
Certified	Yes	LA	SHW07.04110	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Bromomethane
Certified	Yes	LA	SHW07.04120	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Carbon tetrachloride
Certified	Yes	LA	SHW07.04130	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Chloroethane
Certified	Yes	LA	SHW07.04140	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Chloroethyl vinyl ether (2-)
Certified	Yes	LA	SHW07.04150	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Chloroform
Certified	Yes	LA	SHW07.04160	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Chloromethane
Certified	Yes	LA	SHW07.04165	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Diethyl ether (Ethyl ether)
Certified	Yes	LA	SHW07.04170	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloropropene (trans-1,3-)
Certified	Yes	LA	SHW07.04180	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dibromochloromethane

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320 FORBES BLVD
MANSFIELD, MA 02048

Category: SHW07 – Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	SHW07.04185	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dibromoethane (1,2-) (EDB)
Certified	Yes	LA	SHW07.04186	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dibromomethane
Certified	Yes	LA	SHW07.04190	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichlorodifluoromethane
Certified	Yes	LA	SHW07.04200	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloroethane (1,1-)
Certified	Yes	LA	SHW07.04210	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloroethane (1,2-)
Certified	Yes	LA	SHW07.04220	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloroethene (1,1-)
Certified	Yes	LA	SHW07.04230	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloroethene (trans-1,2-)
Certified	Yes	LA	SHW07.04235	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloroethene (cis-1,2-)
Certified	Yes	LA	SHW07.04240	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloropropane (1,2-)
Certified	Yes	LA	SHW07.04241	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B]	Dichloropropane (1,3-)
Certified	Yes	LA	SHW07.04242	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloropropane (2,2-)
Certified	Yes	LA	SHW07.04249	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B]	Dichloropropene (1,1-)
Certified	Yes	LA	SHW07.04250	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dichloropropene (cis-1,3-)
Certified	Yes	LA	SHW07.04259	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Ethanol
Certified	Yes	LA	SHW07.04260	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Methylene chloride (Dichloromethane)
Certified	Yes	LA	SHW07.04270	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Tetrachloroethane (1,1,2,2-)
Certified	Yes	LA	SHW07.04280	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Tetrachloroethene
Certified	Yes	LA	SHW07.04290	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trichloroethane (1,1,1-)
Certified	Yes	LA	SHW07.04300	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trichloroethane (1,1,2-)
Certified	Yes	LA	SHW07.04310	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trichloroethene
Certified	Yes	LA	SHW07.04320	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trichlorofluoromethane
Certified	Yes	LA	SHW07.04325	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trichloropropane (1,2,3-)
Certified	Yes	LA	SHW07.04327	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Vinyl acetate
Certified	Yes	LA	SHW07.04330	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Vinyl chloride
Certified	Yes	LA	SHW07.04340	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Acetone
Certified	Yes	LA	SHW07.04350	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Carbon disulfide
Certified	Yes	LA	SHW07.04360	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Butanone (2-)
Certified	Yes	LA	SHW07.04365	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Ethyl acetate
Certified	Yes	LA	SHW07.04367	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Ethyl methacrylate
Certified	Yes	LA	SHW07.04370	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Hexanone (2-)
Certified	Yes	LA	SHW07.04376	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Iso-butyl alcohol
Certified	Yes	LA	SHW07.04380	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Pentanone (4-methyl-2-) (MIBK)

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Laboratory Name: ALPHA ANALYTICAL Laboratory Number: MA015 Activity ID: NLC100003
320 FORBES BLVD
MANSFIELD, MA 02048

Category: SHW07 – Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	SHW07.04390	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Methyl tert-butyl ether
Certified	Yes	LA	SHW07.04395	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Tert-butyl alcohol
Certified	Yes	LA	SHW07.04398	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Acetonitrile
Certified	Yes	LA	SHW07.04400	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Acrolein
Certified	Yes	LA	SHW07.04410	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Acrylonitrile
Certified	Yes	LA	SHW07.04500	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Hexachlorobutadiene (1,3-)
Certified	Yes	LA	SHW07.04530	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Hexachloroethane
Certified	Yes	LA	SHW07.04540	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260C, Rev. 2, 12/96]	Naphthalene
Certified	Yes	LA	SHW07.04560	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Tetrachloroethane (1,1,1,2-)
Certified	Yes	LA	SHW07.04570	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Trichlorobenzene (1,2,4-)
Certified	Yes	LA	SHW07.04580	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Nitrobenzene
Certified	Yes	LA	SHW07.04590	NPW, SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Dioxane (1,4-)
Certified	Yes	LA	SHW07.04665	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C]	Acetophenone
Certified	Yes	LA	SHW07.04975	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C]	Tetrachlorobenzene (1,2,4,5-)
Certified	Yes	LA	SHW07.05004	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	N-Nitrosodiethylamine
Certified	Yes	LA	SHW07.05005	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	N-Nitrosodimethylamine
Certified	Yes	LA	SHW07.05006	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	N-Nitroso-di-n-propylamine
Certified	Yes	LA	SHW07.05010	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	N-Nitrosodiphenylamine
Certified	Yes	LA	SHW07.05011	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	N-Nitrosomethylethylamine
Certified	Yes	LA	SHW07.05012	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	N-Nitrosopyrrolidine
Certified	Yes	LA	SHW07.05020	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Diphenylamine
Certified	Yes	LA	SHW07.05030	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Carbazole
Certified	Yes	LA	SHW07.05038	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Benzidine
Certified	Yes	LA	SHW07.05040	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dichlorobenzidine (3,3'-)
Certified	Yes	LA	SHW07.05048	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Aniline
Certified	Yes	LA	SHW07.05050	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Chloraniline (4-)
Certified	Yes	LA	SHW07.05060	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Nitroaniline (2-)
Certified	Yes	LA	SHW07.05062	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Nitroaniline (3-)
Certified	Yes	LA	SHW07.05063	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Nitroaniline (4-)
Certified	Yes	LA	SHW07.05080	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Hexachlorobenzene
Certified	Yes	LA	SHW07.05090	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Hexachlorobutadiene (1,3-)
Certified	Yes	LA	SHW07.05100	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Hexachlorocyclopentadiene

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 01/03/2011 until 06/30/2011

Laboratory Name: ALPHA ANALYTICAL Laboratory Number: MA015 Activity ID: NLC100003
320 FORBES BLVD
MANSFIELD, MA 02048

Category: SHW07 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	SHW07.05110	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Hexachloroethane
Certified	Yes	LA	SHW07.05120	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Trichlorobenzene (1,2,4-)
Certified	Yes	LA	SHW07.05130	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Bis (2-chloroethoxy) methane
Certified	Yes	LA	SHW07.05132	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Bis (2-chloroethyl) ether
Certified	Yes	LA	SHW07.05140	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Bis (2-chloroisopropyl) ether
Certified	Yes	LA	SHW07.05150	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Chlorophenyl-phenyl ether (4-)
Certified	Yes	LA	SHW07.05160	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Bromophenyl-phenyl ether (4-)
Certified	Yes	LA	SHW07.05170	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dinitrotoluene (2,4-)
Certified	Yes	LA	SHW07.05180	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dinitrotoluene (2,6-)
Certified	Yes	LA	SHW07.05190	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Isophorone
Certified	Yes	LA	SHW07.05200	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Nitrobenzene
Certified	Yes	LA	SHW07.05210	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Butyl benzyl phthalate
Certified	Yes	LA	SHW07.05220	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Bis (2-ethylhexyl) phthalate
Certified	Yes	LA	SHW07.05230	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Diethyl phthalate
Certified	Yes	LA	SHW07.05240	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dimethyl phthalate
Certified	Yes	LA	SHW07.05250	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Di-n-butyl phthalate
Certified	Yes	LA	SHW07.05260	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Di-n-octyl phthalate
Certified	Yes	LA	SHW07.05440	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Methyl phenol (4-chloro-3-)
Certified	Yes	LA	SHW07.05450	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Chlorophenol (2-)
Certified	Yes	LA	SHW07.05460	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dichlorophenol (2,4-)
Certified	Yes	LA	SHW07.05470	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dimethylphenol (2,4-)
Certified	Yes	LA	SHW07.05480	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dinitrophenol (2,4-)
Certified	Yes	LA	SHW07.05490	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dinitrophenol (2-methyl-4,6-)
Certified	Yes	LA	SHW07.05500	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Methylphenol (2-)
Certified	Yes	LA	SHW07.05510	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Methylphenol (4-)
Certified	Yes	LA	SHW07.05520	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Nitrophenol (2-)
Certified	Yes	LA	SHW07.05530	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Nitrophenol (4-)
Certified	Yes	LA	SHW07.05540	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Pentachlorophenol
Certified	Yes	LA	SHW07.05550	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Phenol
Certified	Yes	LA	SHW07.05560	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Trichlorophenol (2,4,5-)
Certified	Yes	LA	SHW07.05570	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Trichlorophenol (2,4,6-)
Certified	Yes	LA	SHW07.05590	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Methylphenol (3-)

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New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 01/03/2011 until 06/30/2011

Laboratory Name: ALPHA ANALYTICAL Laboratory Number: MA015 Activity ID: NLC100003
320 FORBES BLVD
MANSFIELD, MA 02048

Category: SHW07 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	SHW07.05691	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dichlorobenzene (1,2-)
Certified	Yes	LA	SHW07.05692	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dichlorobenzene (1,3-)
Certified	Yes	LA	SHW07.05700	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Dichlorobenzene (1,4-)
Certified	Yes	LA	SHW07.05710	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Benzoic acid
Certified	Yes	LA	SHW07.05720	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Benzyl alcohol
Certified	Yes	LA	SHW07.05750	NPW, SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C, Rev. 3, 12/96]	Pyridine

Category: SHW09 -- Miscellaneous Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	SHW09.03000	NPW, SCM	Distillation	[SW-846 9010B, Rev. 2, 12/96]	Cyanide - amenable to Cl2
Certified	Yes	LA	SHW09.04100	NPW, SCM	Titrimetric/Manual Spectrophotometric	[SW-846 9014, Rev. 0, 12/96]	Cyanide

Category: SHW02 -- Characteristics of Hazardous Waste

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	SHW02.07000	SCM	TCLP, Toxicity Procedure, Shaker	[SW-846 1311, Rev. 0, 7/92]	Metals

Category: SHW04 -- Inorganic Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	SHW04.03000	SCM	Acid Digestion, Soil Sediment & Sludge	[SW-846 3050B, Rev. 2, 12/96]	Metals
Certified	Yes	LA	SHW04.03500	SCM	Microwave Acid Digest: Soil Sediment & Sludge	[SW-846 3051, Rev. 0, 9/94]	Metals
Certified	Yes	LA	SHW04.03700	SCM	Chromium VI Digestion	[SW-846 3060A, Rev. 1, 12/96]	Metals
Certified	Yes	LA	SHW04.21000	SCM	Colorimetric	[SW-846 7196A, Rev. 1, 7/92]	Chromium (VI)
Certified	Yes	LA	SHW04.33000	SCM	AA, Manual Cold Vapor	[SW-846 7470A, Rev. 1, 9/94]	Mercury - liquid waste
Certified	Yes	LA	SHW04.33500	SCM	AA, Manual Cold Vapor	[SW-846 7471A, Rev. 1, 9/94]	Mercury - solid waste
Certified	Yes	LA	SHW04.33800	SCM	Atomic Fluorescence	[SW-846 7474]	Mercury - soils/sediments

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New Jersey Department of Environmental Protection

National Environmental Laboratory Accreditation Program

ANNUAL CERTIFIED PARAMETER LIST AND CURRENT STATUS

Effective as of 01/03/2011 until 06/30/2011

Laboratory Name: ALPHA ANALYTICAL Laboratory Number: MA015 Activity ID: NLC100003
320 FORBES BLVD
MANSFIELD, MA 02048

Category: SHW05 -- Organic Parameters, Prep. / Screening

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	NJ	SHW05.03000	SCM	Soxhlet Extraction	[SW-846 3540C]	Semivolatile organics
Applied	No	LA	SHW05.12000	SCM	Cleanup-Florisil	[SW-846 3620B, Rev. 2, 12/96]	Semivolatile organics

Category: SHW07 -- Organic Parameters, Chromatography/MS

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	SHW07.04550	SCM	GC/MS, P & T or Direct Injection, Capillary	[SW-846 8260B, Rev. 2, 12/96]	Styrene
Certified	Yes	LA	SHW07.05045	SCM	GC/MS, Extract or Dir Inj, Capillary	[SW-846 8270C]	Diphenylhydrazine (1,2-)

Category: SHW09 -- Miscellaneous Parameters

Status	Eligible to Report NJ Data	State	Code	Matrix	Technique Description	Approved Method	Parameter Description
Certified	Yes	LA	SHW09.02000	SCM	Distillation	[SW-846 9010B, Rev. 2, 12/96]	Cyanide
Certified	Yes	LA	SHW09.16000	SCM	Mix with Water or Calcium Chloride	[SW-846 9045C, Rev. 3, 1/95]	pH - soil and waste
Certified	Yes	LA	SHW09.19000	SCM	Infrared Spectrometry or FID	[SW-846 9060, Rev. 0, 9/86]	Total organic carbon (TOC)

Joseph F. Aiello, Chief

KEY: AE = Air and Emissions, BT = Biological Tissues, DW = Drinking Water, NPW = Non-Potable Water, SCM = Solid and Chemical Materials

Phillip Worby
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810

SOIL-70 Final Report

Soil/Hazardous Waste Proficiency Testing

Soil Study

Open Date: 04/19/10

Close Date: 06/03/10

Report Issued Date: 06/24/10

June 24, 2010

Phillip Worby
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810

Enclosed is your final report for ERA's SOIL-70 Proficiency Testing (PT) study. Your final report includes an evaluation of all results submitted by your laboratory to ERA.

Data Evaluation Protocols: All analytes in ERA's SOIL-70 Proficiency Testing (PT) study have been evaluated using the following tiered approach. If the analyte is listed in the most current National Environmental Laboratory Accreditation Conference (NELAC) PT Field of Testing tables, the evaluation was completed by comparing the reported result to the acceptance limits generated using the criteria contained in the NELAC FoPT tables. If the analyte is not included in the NELAC FoPT tables, the reported result has been evaluated using the procedures outlined in ERA's Standard Operating Procedure for the Generation of Performance Acceptance Limits (SOP 0260).

Corrective Action Help: As part of your accreditation(s), you may be required to identify the root cause of any "Not Acceptable" results, implement the necessary corrective actions, and then satisfy your PT requirements by participating in a Supplemental (QuiK™ Response) or future ERA PT study. ERA's technical staff is available to help your laboratory resolve any technical issues that may be impairing your PT performance and possibly affecting your routine data quality. Our laboratory and technical staff have well over three hundred years of collective experience in performing the full range of environmental analyses. As part of our technical support, ERA offers QC samples that can be helpful in helping you work through your technical issues.

Thank you for your participation in ERA's SOIL-70 Proficiency Testing study. If you have any questions, please contact Shawn Kassner, Proficiency Testing Manager, or Curtis Wood, Director of Regulatory Affairs and Business Development, at 1-800-372-0122.

Sincerely,

Shawn Kassner
Proficiency Testing Manager

Jay R. McBurney
Quality Program Manager

attachments
smk

Report Recipient	Contact/Phone Number	Reporting Type
Minnesota	Susan Wyatt / 651-201-5323	All Analytes
New Jersey	Rachel Ellis / 609-777-1749	All Analytes
Oklahoma	David Caldwell / 405-702-1039	All Analytes
South Carolina	Carol Smith / 803-896-0992	All Analytes
West Virginia (DEP)	Daniel T. Arnold / 304-926-0499 x1341	All Analytes
Enovis	Tim Abston / 313-872-6151	All Analytes

SOIL-70 Definitions & Study Discussion

Study Dates: 04/19/10 - 06/03/10 **Report Issued: 06/24/10**

SOIL Study Definitions

The Reported Value is the value that the laboratory reported to ERA.

The ERA assigned value for the Organic Proficiency Testing Standards is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation as applicable. The ERA assigned value for the Inorganic Proficiency Testing Standards, with the exception of the TCLP Metals in Soil, is equal to the maximum amount of the parameter available in the standard by applicable EPA methodologies. The ERA assigned value for the TCLP metals is equal to the mean of ERA's internal analytical analyses. All NELAC parameters not added to a standard are given an assigned Value of "0", per the guidance issued by the NELAC Board of Directors, on December 14, 2000. Non-NELAC parameters not added to a standard may be given an assigned value of less than a minimum verified concentration as determined in the background soil for applicable EPA methodologies.

The Acceptance Limits are established per the NELAC PT program criteria or ERA's SOP for the Generation of Performance Acceptance Limits™ as applicable.

The Performance Evaluation:

Acceptable	= Reported Value falls within the Acceptance Limits.
Not Acceptable	= Reported Value falls outside the Acceptance Limits.
No Evaluation	= Reported Value cannot be evaluated.
Not Reported	= No Value reported.

The Method Description is the method the laboratory reported to ERA.

SOIL Study Discussion

ERA's SOIL-70 Proficiency Testing (PT) study has been reviewed by ERA senior management and certified compliant with the requirements of the National Environmental Laboratory Accreditation Conference (NELAC), Proficiency Testing Program Standards, Chapter 2, July 2003.

Per the requirements of the NELAC Proficiency Testing Program, a full review of all homogeneity, stability, and accuracy verification data was completed. All analytical verification data for all analytes in the Soil study standards met the acceptance criteria contained in the NELAC Proficiency Testing Program Standards, Chapter 2, July 2003. If the analyte is included in the NELAC Fields of Testing list the acceptance limits were calculated based on the NELAC Proficiency Testing Program Standards, Chapter 2, July 2003. If the analyte is not included in the NELAC Fields of Testing list, the acceptance limits were calculated using the procedures outlined in ERA's Standard Operating Procedure for the Generation of Performance Acceptance Limits (SOP 0260, Rev. 2.0).

The data submitted by participating laboratories was also examined for study anomalies. There were no anomalies observed during the statistical review of the data.

If you have any questions or concerns regarding your assessment in ERA's SOIL Proficiency Testing program, please contact Shawn Kassner, Proficiency Testing Manager, or Curtis Wood, Director of Regulatory Affairs and Business Development, at 1-800-372-0122.

ACCREDITED
Lab Code 1533-01

Study: **SOIL-70**

ERA Customer Number: **A064801**

Laboratory Name: **Accutest Mid Atlantic**

Inorganic Results

SOIL-70 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 06/24/10
Study Dates: 04/19/10 - 06/03/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Metals in Soil (cat# 620)							
1000	Aluminum	mg/kg	12400	10100	3600 - 13800	Acceptable	EPA 6010B
1005	Antimony	mg/kg	84.6	235	23.5 - 258	Acceptable	EPA 6010B
1010	Arsenic	mg/kg	136	167	96.4 - 184	Acceptable	EPA 6010B
1015	Barium	mg/kg	314	313	214 - 366	Acceptable	EPA 6010B
1020	Beryllium	mg/kg	144	154	104 - 172	Acceptable	EPA 6010B
1025	Boron	mg/kg	124	147	73.4 - 167	Acceptable	EPA 6010B
1030	Cadmium	mg/kg	85.6	88.5	62.3 - 108	Acceptable	EPA 6010B
1035	Calcium	mg/kg	6320	6380	4520 - 7730	Acceptable	EPA 6010B
1040	Chromium	mg/kg	178	187	118 - 217	Acceptable	EPA 6010B
1050	Cobalt	mg/kg	87.2	98.1	64.7 - 109	Acceptable	EPA 6010B
1055	Copper	mg/kg	196	209	142 - 233	Acceptable	EPA 6010B
1070	Iron	mg/kg	14500	15000	3860 - 21100	Acceptable	EPA 6010B
1075	Lead	mg/kg	129	134	86.8 - 154	Acceptable	EPA 6010B
1085	Magnesium	mg/kg	3190	3170	1920 - 3930	Acceptable	EPA 6010B
1090	Manganese	mg/kg	304	313	231 - 388	Acceptable	EPA 6010B
1095	Mercury	mg/kg		8.29	3.94 - 11.4	Not Reported	
1100	Molybdenum	mg/kg	151	176	102 - 194	Acceptable	EPA 6010B
1105	Nickel	mg/kg	170	179	117 - 202	Acceptable	EPA 6010B
1125	Potassium	mg/kg	3240	3070	1720 - 3840	Acceptable	EPA 6010B
1140	Selenium	mg/kg	43.4	49.7	24.4 - 62.6	Acceptable	EPA 6010B
1150	Silver	mg/kg	55.2	62.6	36.8 - 73.6	Acceptable	EPA 6010B
1155	Sodium	mg/kg	514	544	257 - 751	Acceptable	EPA 6010B
1160	Strontium	mg/kg	214	222	144 - 263	Acceptable	EPA 6010B
1165	Thallium	mg/kg	152	168	100 - 193	Acceptable	EPA 6010B
1175	Tin	mg/kg	163	186	99.0 - 229	Acceptable	EPA 6010B
1180	Titanium	mg/kg	426	301	0.00 - 556	Acceptable	EPA 6010B
1185	Vanadium	mg/kg	144	156	96.8 - 180	Acceptable	EPA 6010B
1190	Zinc	mg/kg	211	221	144 - 268	Acceptable	EPA 6010B

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

SOIL-70 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 06/24/10
Study Dates: 04/19/10 - 06/03/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Metals in Soil (cat# 620)							
1000	Aluminum	mg/kg	13300	10100	3600 - 13800	Acceptable	EPA 6020
1005	Antimony	mg/kg	89.2	235	23.5 - 258	Acceptable	EPA 6020
1010	Arsenic	mg/kg	136	167	96.4 - 184	Acceptable	EPA 6020
1015	Barium	mg/kg	304	313	214 - 366	Acceptable	EPA 6020
1020	Beryllium	mg/kg	138	154	104 - 172	Acceptable	EPA 6020
1025	Boron	mg/kg		147	73.4 - 167	Not Reported	
1030	Cadmium	mg/kg	84.9	88.5	62.3 - 108	Acceptable	EPA 6020
1035	Calcium	mg/kg	6680	6380	4520 - 7730	Acceptable	EPA 6020
1040	Chromium	mg/kg	187	187	118 - 217	Acceptable	EPA 6020
1050	Cobalt	mg/kg	94.7	98.1	64.7 - 109	Acceptable	EPA 6020
1055	Copper	mg/kg	199	209	142 - 233	Acceptable	EPA 6020
1070	Iron	mg/kg	15600	15000	3860 - 21100	Acceptable	EPA 6020
1075	Lead	mg/kg	126	134	86.8 - 154	Acceptable	EPA 6020
1085	Magnesium	mg/kg	3470	3170	1920 - 3930	Acceptable	EPA 6020
1090	Manganese	mg/kg	352	313	231 - 388	Acceptable	EPA 6020
1095	Mercury	mg/kg		8.29	3.94 - 11.4	Not Reported	
1100	Molybdenum	mg/kg	154	176	102 - 194	Acceptable	EPA 6020
1105	Nickel	mg/kg	169	179	117 - 202	Acceptable	EPA 6020
1125	Potassium	mg/kg	3410	3070	1720 - 3840	Acceptable	EPA 6020
1140	Selenium	mg/kg	44.1	49.7	24.4 - 62.6	Acceptable	EPA 6020
1150	Silver	mg/kg	55.8	62.6	36.8 - 73.6	Acceptable	EPA 6020
1155	Sodium	mg/kg	541	544	257 - 751	Acceptable	EPA 6020
1160	Strontium	mg/kg	217	222	144 - 263	Acceptable	EPA 6020
1165	Thallium	mg/kg	152	168	100 - 193	Acceptable	EPA 6020
1175	Tin	mg/kg	164	186	99.0 - 229	Acceptable	EPA 6020
1180	Titanium	mg/kg	419	301	0.00 - 556	Acceptable	EPA 6020
1185	Vanadium	mg/kg	154	156	96.8 - 180	Acceptable	EPA 6020
1190	Zinc	mg/kg	218	221	144 - 268	Acceptable	EPA 6020

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SOIL-70 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 06/24/10
Study Dates: 04/19/10 - 06/03/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Metals in Soil (cat# 620)							
1000	Aluminum	mg/kg		10100	3600 - 13800	Not Reported	
1005	Antimony	mg/kg		235	23.5 - 258	Not Reported	
1010	Arsenic	mg/kg		167	96.4 - 184	Not Reported	
1015	Barium	mg/kg		313	214 - 366	Not Reported	
1020	Beryllium	mg/kg		154	104 - 172	Not Reported	
1025	Boron	mg/kg		147	73.4 - 167	Not Reported	
1030	Cadmium	mg/kg		88.5	62.3 - 108	Not Reported	
1035	Calcium	mg/kg		6380	4520 - 7730	Not Reported	
1040	Chromium	mg/kg		187	118 - 217	Not Reported	
1050	Cobalt	mg/kg		98.1	64.7 - 109	Not Reported	
1055	Copper	mg/kg		209	142 - 233	Not Reported	
1070	Iron	mg/kg		15000	3860 - 21100	Not Reported	
1075	Lead	mg/kg		134	86.8 - 154	Not Reported	
1085	Magnesium	mg/kg		3170	1920 - 3930	Not Reported	
1090	Manganese	mg/kg		313	231 - 388	Not Reported	
1095	Mercury	mg/kg	7.2	8.29	3.94 - 11.4	Acceptable	EPA 7471A
1100	Molybdenum	mg/kg		176	102 - 194	Not Reported	
1105	Nickel	mg/kg		179	117 - 202	Not Reported	
1125	Potassium	mg/kg		3070	1720 - 3840	Not Reported	
1140	Selenium	mg/kg		49.7	24.4 - 62.6	Not Reported	
1150	Silver	mg/kg		62.6	36.8 - 73.6	Not Reported	
1155	Sodium	mg/kg		544	257 - 751	Not Reported	
1160	Strontium	mg/kg		222	144 - 263	Not Reported	
1165	Thallium	mg/kg		168	100 - 193	Not Reported	
1175	Tin	mg/kg		186	99.0 - 229	Not Reported	
1180	Titanium	mg/kg		301	0.00 - 556	Not Reported	
1185	Vanadium	mg/kg		156	96.8 - 180	Not Reported	
1190	Zinc	mg/kg		221	144 - 268	Not Reported	
SOIL Hexavalent Chromium in Soil (cat# 876)							
1045	Chromium VI	mg/kg	167	192	54.2 - 244	Acceptable	EPA 7199
SOIL Hexavalent Chromium in Soil (cat# 876)							
1045	Chromium VI	mg/kg	159	192	54.2 - 244	Acceptable	EPA 7196A

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Metals in Sewage SludG™ (cat# 619)							
1000	Aluminum	mg/kg	15500	16400	2430 - 28800	Acceptable	EPA 6010B
1005	Antimony	mg/kg	138	261	68.1 - 287	Acceptable	EPA 6010B
1010	Arsenic	mg/kg	196	256	127 - 282	Acceptable	EPA 6010B
1015	Barium	mg/kg	735	906	121 - 1430	Acceptable	EPA 6010B
1020	Beryllium	mg/kg	103	130	43.4 - 183	Acceptable	EPA 6010B
1030	Cadmium	mg/kg	126	144	70.6 - 180	Acceptable	EPA 6010B
1035	Calcium	mg/kg	19100	21300	11600 - 28500	Acceptable	EPA 6010B
1040	Chromium	mg/kg	142	173	83.8 - 224	Acceptable	EPA 6010B
1050	Cobalt	mg/kg	34.1	40.3	23.7 - 49.2	Acceptable	EPA 6010B
1055	Copper	mg/kg	814	910	660 - 1070	Acceptable	EPA 6010B
1070	Iron	mg/kg	11500	12300	5460 - 17000	Acceptable	EPA 6010B
1075	Lead	mg/kg	158	191	96.7 - 224	Acceptable	EPA 6010B
1085	Magnesium	mg/kg	2730	3040	1760 - 3800	Acceptable	EPA 6010B
1090	Manganese	mg/kg	790	872	339 - 1290	Acceptable	EPA 6010B
1095	Mercury	mg/kg		16.6	6.22 - 24.8	Not Reported	
1100	Molybdenum	mg/kg	168	203	109 - 250	Acceptable	EPA 6010B
1105	Nickel	mg/kg	155	176	71.7 - 226	Acceptable	EPA 6010B
1125	Potassium	mg/kg	2320	2670	1420 - 3250	Acceptable	EPA 6010B
1140	Selenium	mg/kg	186	216	128 - 238	Acceptable	EPA 6010B
1150	Silver	mg/kg	81.5	105	38.9 - 139	Acceptable	EPA 6010B
1155	Sodium	mg/kg	1310	1520	710 - 2050	Acceptable	EPA 6010B
1160	Strontium	mg/kg	395	444	164 - 600	Acceptable	EPA 6010B
1165	Thallium	mg/kg	130	157	14.1 - 223	Acceptable	EPA 6010B
1185	Vanadium	mg/kg	121	161	85.1 - 194	Acceptable	EPA 6010B
1190	Zinc	mg/kg	1170	1310	834 - 1760	Acceptable	EPA 6010B

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Metals in Sewage SludG™ (cat# 619)							
1000	Aluminum	mg/kg	16400	16400	2430 - 28800	Acceptable	EPA 6020
1005	Antimony	mg/kg	155	261	68.1 - 287	Acceptable	EPA 6020
1010	Arsenic	mg/kg	197	256	127 - 282	Acceptable	EPA 6020
1015	Barium	mg/kg	776	906	121 - 1430	Acceptable	EPA 6020
1020	Beryllium	mg/kg	102	130	43.4 - 183	Acceptable	EPA 6020
1030	Cadmium	mg/kg	128	144	70.6 - 180	Acceptable	EPA 6020
1035	Calcium	mg/kg	21000	21300	11600 - 28500	Acceptable	EPA 6020
1040	Chromium	mg/kg	144	173	83.8 - 224	Acceptable	EPA 6020
1050	Cobalt	mg/kg	35.1	40.3	23.7 - 49.2	Acceptable	EPA 6020
1055	Copper	mg/kg	866	910	660 - 1070	Acceptable	EPA 6020
1070	Iron	mg/kg	11800	12300	5460 - 17000	Acceptable	EPA 6020
1075	Lead	mg/kg	160	191	96.7 - 224	Acceptable	EPA 6020
1085	Magnesium	mg/kg	3010	3040	1760 - 3800	Acceptable	EPA 6020
1090	Manganese	mg/kg	895	872	339 - 1290	Acceptable	EPA 6020
1095	Mercury	mg/kg		16.6	6.22 - 24.8	Not Reported	
1100	Molybdenum	mg/kg	181	203	109 - 250	Acceptable	EPA 6020
1105	Nickel	mg/kg	151	176	71.7 - 226	Acceptable	EPA 6020
1125	Potassium	mg/kg	2350	2670	1420 - 3250	Acceptable	EPA 6020
1140	Selenium	mg/kg	189	216	128 - 238	Acceptable	EPA 6020
1150	Silver	mg/kg	84.9	105	38.9 - 139	Acceptable	EPA 6020
1155	Sodium	mg/kg	1350	1520	710 - 2050	Acceptable	EPA 6020
1160	Strontium	mg/kg	419	444	164 - 600	Acceptable	EPA 6020
1165	Thallium	mg/kg	134	157	14.1 - 223	Acceptable	EPA 6020
1185	Vanadium	mg/kg	136	161	85.1 - 194	Acceptable	EPA 6020
1190	Zinc	mg/kg	1400	1310	834 - 1760	Acceptable	EPA 6020

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Metals in Sewage SludG™ (cat# 619)							
1000	Aluminum	mg/kg		16400	2430 - 28800	Not Reported	
1005	Antimony	mg/kg		261	68.1 - 287	Not Reported	
1010	Arsenic	mg/kg		256	127 - 282	Not Reported	
1015	Barium	mg/kg		906	121 - 1430	Not Reported	
1020	Beryllium	mg/kg		130	43.4 - 183	Not Reported	
1030	Cadmium	mg/kg		144	70.6 - 180	Not Reported	
1035	Calcium	mg/kg		21300	11600 - 28500	Not Reported	
1040	Chromium	mg/kg		173	83.8 - 224	Not Reported	
1050	Cobalt	mg/kg		40.3	23.7 - 49.2	Not Reported	
1055	Copper	mg/kg		910	660 - 1070	Not Reported	
1070	Iron	mg/kg		12300	5460 - 17000	Not Reported	
1075	Lead	mg/kg		191	96.7 - 224	Not Reported	
1085	Magnesium	mg/kg		3040	1760 - 3800	Not Reported	
1090	Manganese	mg/kg		872	339 - 1290	Not Reported	
1095	Mercury	mg/kg	14.9	16.6	6.22 - 24.8	Acceptable	EPA 7471A
1100	Molybdenum	mg/kg		203	109 - 250	Not Reported	
1105	Nickel	mg/kg		176	71.7 - 226	Not Reported	
1125	Potassium	mg/kg		2670	1420 - 3250	Not Reported	
1140	Selenium	mg/kg		216	128 - 238	Not Reported	
1150	Silver	mg/kg		105	38.9 - 139	Not Reported	
1155	Sodium	mg/kg		1520	710 - 2050	Not Reported	
1160	Strontium	mg/kg		444	164 - 600	Not Reported	
1165	Thallium	mg/kg		157	14.1 - 223	Not Reported	
1185	Vanadium	mg/kg		161	85.1 - 194	Not Reported	
1190	Zinc	mg/kg		1310	834 - 1760	Not Reported	
SOIL Anions in Soil (cat# 873)							
1540	Bromide	mg/kg	60.2	72.7	50.2 - 81.6	Acceptable	EPA 9056
1575	Chloride	mg/kg	211	227	141 - 294	Acceptable	EPA 9056
1730	Fluoride	mg/kg	57.9	198	20.0 - 218	Acceptable	EPA 9056
1810	Nitrate as N	mg/kg	214	291	170 - 320	Acceptable	EPA 9056
1870	Phosphate as P	mg/kg		243	30.5 - 267	Not Reported	
2000	Sulfate	mg/kg	184	206	134 - 227	Acceptable	EPA 9056
SOIL Cyanide in Soil (cat# 621)							
1635	Cyanide, total	mg/kg	38.4	54.1	21.3 - 72.3	Acceptable	EPA 9012
1640	Reactive Cyanide	mg/kg		< 25.0		Not Reported	

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Nutrients in Soil (cat# 869)							
1515	Ammonia as N	mg/kg		486	52.7 - 660	Not Reported	
1795	Total Kjeldahl Nitrogen	mg/kg		764	331 - 1110	Not Reported	
2040	Total Organic Carbon (TOC)	mg/kg	2050	2420	242 - 5550	Acceptable	EPA 9060
1910	Total Phosphorus	mg/kg		782	410 - 1120	Not Reported	
SOIL Corrosivity/pH in Soil (cat# 875)							
1625	Corrosivity (pH)	S.U.	7.5	7.60	7.00 - 8.20	Acceptable	EPA 9045C
SOIL Ignitability/Flashpoint (cat# 874)							
1780	Ignitability/Flashpoint	°F	138	138	121 - 155	Acceptable	EPA 1010A

Study: **SOIL-70**

ERA Customer Number: **A064801**

Laboratory Name: **Accutest Mid Atlantic**

Organic Results

SOIL-70 Final Complete Report

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Volatiles in Soil (cat# 623)							
4315	Acetone	µg/kg		259	40.0 - 507	Not Reported	
4320	Acetonitrile	µg/kg		709	0.00 - 1270	Not Reported	
4325	Acrolein	µg/kg		0.00		Not Reported	
4375	Benzene	µg/kg	148	141	85.0 - 192	Acceptable	EPA 8021B
4385	Bromobenzene	µg/kg		124	86.9 - 169	Not Reported	
4395	Bromodichloromethane	µg/kg		36.8	21.5 - 52.0	Not Reported	
4400	Bromoform	µg/kg		80.6	40.4 - 120	Not Reported	
4950	Bromomethane	µg/kg		0.00		Not Reported	
4410	2-Butanone (MEK)	µg/kg		347	143 - 553	Not Reported	
5000	tert-Butyl methyl ether (MTBE)	µg/kg	0	0.00		Acceptable	EPA 8021B
4450	Carbon disulfide	µg/kg		0.00		Not Reported	
4455	Carbon tetrachloride	µg/kg		94.3	46.0 - 139	Not Reported	
4475	Chlorobenzene	µg/kg	45.2	43.2	23.3 - 59.4	Acceptable	EPA 8021B
4575	Chlorodibromomethane	µg/kg		0.00		Not Reported	
4485	Chloroethane	µg/kg		150	73.6 - 234	Not Reported	
4500	2-Chloroethylvinylether	µg/kg		0.00		Not Reported	
4505	Chloroform	µg/kg		0.00		Not Reported	
4960	Chloromethane	µg/kg		0.00		Not Reported	
4570	1,2-Dibromo-3-chloropropane (DBCP)	µg/kg		0.00		Not Reported	
4585	1,2-Dibromoethane (EDB)	µg/kg		0.00		Not Reported	
4595	Dibromomethane	µg/kg		0.00		Not Reported	
4610	1,2-Dichlorobenzene	µg/kg	0	0.00		Acceptable	EPA 8021B
4615	1,3-Dichlorobenzene	µg/kg	74.7	70.0	25.6 - 103	Acceptable	EPA 8021B
4620	1,4-Dichlorobenzene	µg/kg	194	187	64.4 - 265	Acceptable	EPA 8021B
4625	Dichlorodifluoromethane (Freon 12)	µg/kg		0.00		Not Reported	
4630	1,1-Dichloroethane	µg/kg		112	63.5 - 162	Not Reported	
4635	1,2-Dichloroethane	µg/kg		0.00		Not Reported	
4640	1,1-Dichloroethylene	µg/kg		167	84.2 - 282	Not Reported	
4645	cis-1,2-Dichloroethylene	µg/kg	120	104	66.7 - 151	Acceptable	EPA 8021B
4700	trans-1,2-Dichloroethylene	µg/kg	130	120	71.2 - 188	Acceptable	EPA 8021B
4655	1,2-Dichloropropane	µg/kg		130	76.1 - 174	Not Reported	
4680	cis-1,3-Dichloropropylene	µg/kg	86.8	80.8	60.3 - 107	Acceptable	EPA 8021B

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Volatiles in Soil (cat# 623) (Continued)							
4685	trans-1,3-Dichloropropylene	µg/kg	158	157	104 - 220	Acceptable	EPA 8021B
4765	Ethylbenzene	µg/kg	69.7	71.7	39.1 - 104	Acceptable	EPA 8021B
4860	2-Hexanone	µg/kg		363	83.6 - 602	Not Reported	
4900	Isopropylbenzene	µg/kg	0	0.00		Acceptable	EPA 8021B
4975	Methylene chloride	µg/kg		123	57.4 - 178	Not Reported	
4995	4-Methyl-2-pentanone (MIBK)	µg/kg		113	47.2 - 168	Not Reported	
5005	Naphthalene	µg/kg	89.0	85.2	40.3 - 123	Acceptable	EPA 8021B
5100	Styrene	µg/kg	0	0.00		Acceptable	EPA 8021B
5105	1,1,1,2-Tetrachloroethane	µg/kg		165	108 - 223	Not Reported	
5110	1,1,2,2-Tetrachloroethane	µg/kg		0.00		Not Reported	
5115	Tetrachloroethylene	µg/kg	193	184	83.1 - 266	Acceptable	EPA 8021B
5140	Toluene	µg/kg	85.3	84.0	48.0 - 118	Acceptable	EPA 8021B
5155	1,2,4-Trichlorobenzene	µg/kg		171	84.6 - 246	Not Reported	
5160	1,1,1-Trichloroethane	µg/kg		136	77.5 - 194	Not Reported	
5165	1,1,2-Trichloroethane	µg/kg		0.00		Not Reported	
5170	Trichloroethylene	µg/kg	148	140	72.0 - 200	Acceptable	EPA 8021B
5175	Trichlorofluoromethane	µg/kg		97.9	56.2 - 163	Not Reported	
5180	1,2,3-Trichloropropane (TCP)	µg/kg		86.4	33.5 - 144	Not Reported	
5225	Vinyl acetate	µg/kg		0.00		Not Reported	
5235	Vinyl chloride	µg/kg		0.00		Not Reported	
5260	Xylenes, total	µg/kg	125	137	66.5 - 203	Acceptable	EPA 8021B

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Volatiles in Soil (cat# 623)							
4315	Acetone	µg/kg	320	259	40.0 - 507	Acceptable	EPA 8260B
4320	Acetonitrile	µg/kg	548	709	0.00 - 1270	Acceptable	EPA 8260B
4325	Acrolein	µg/kg	0	0.00		Acceptable	EPA 8260B
4375	Benzene	µg/kg	122	141	85.0 - 192	Acceptable	EPA 8260B
4385	Bromobenzene	µg/kg	110	124	86.9 - 169	Acceptable	EPA 8260B
4395	Bromodichloromethane	µg/kg	37.3	36.8	21.5 - 52.0	Acceptable	EPA 8260B
4400	Bromoform	µg/kg	72.7	80.6	40.4 - 120	Acceptable	EPA 8260B
4950	Bromomethane	µg/kg	0	0.00		Acceptable	EPA 8260B
4410	2-Butanone (MEK)	µg/kg	400	347	143 - 553	Acceptable	EPA 8260B
5000	tert-Butyl methyl ether (MTBE)	µg/kg	0	0.00		Acceptable	EPA 8260B
4450	Carbon disulfide	µg/kg	0	0.00		Acceptable	EPA 8260B
4455	Carbon tetrachloride	µg/kg	101	94.3	46.0 - 139	Acceptable	EPA 8260B
4475	Chlorobenzene	µg/kg	41.2	43.2	23.3 - 59.4	Acceptable	EPA 8260B
4575	Chlorodibromomethane	µg/kg	0	0.00		Acceptable	EPA 8260B
4485	Chloroethane	µg/kg	137	150	73.6 - 234	Acceptable	EPA 8260B
4500	2-Chloroethylvinylether	µg/kg	0	0.00		Acceptable	EPA 8260B
4505	Chloroform	µg/kg	0	0.00		Acceptable	EPA 8260B
4960	Chloromethane	µg/kg	0	0.00		Acceptable	EPA 8260B
4570	1,2-Dibromo-3-chloropropane (DBCP)	µg/kg	0	0.00		Acceptable	EPA 8260B
4585	1,2-Dibromoethane (EDB)	µg/kg	0	0.00		Acceptable	EPA 8260B
4595	Dibromomethane	µg/kg	0	0.00		Acceptable	EPA 8260B
4610	1,2-Dichlorobenzene	µg/kg	0	0.00		Acceptable	EPA 8260B
4615	1,3-Dichlorobenzene	µg/kg	61.1	70.0	25.6 - 103	Acceptable	EPA 8260B
4620	1,4-Dichlorobenzene	µg/kg	135	187	64.4 - 265	Acceptable	EPA 8260B
4625	Dichlorodifluoromethane (Freon 12)	µg/kg	0	0.00		Acceptable	EPA 8260B
4630	1,1-Dichloroethane	µg/kg	107	112	63.5 - 162	Acceptable	EPA 8260B
4635	1,2-Dichloroethane	µg/kg	0	0.00		Acceptable	EPA 8260B
4640	1,1-Dichloroethylene	µg/kg	176	167	84.2 - 282	Acceptable	EPA 8260B
4645	cis-1,2-Dichloroethylene	µg/kg	101	104	66.7 - 151	Acceptable	EPA 8260B
4700	trans-1,2-Dichloroethylene	µg/kg	121	120	71.2 - 188	Acceptable	EPA 8260B
4655	1,2-Dichloropropane	µg/kg	116	130	76.1 - 174	Acceptable	EPA 8260B
4680	cis-1,3-Dichloropropylene	µg/kg	77.2	80.8	60.3 - 107	Acceptable	EPA 8260B

ACCREDITED Lab Code 1539-01

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Volatiles in Soil (cat# 623) (Continued)							
4685	trans-1,3-Dichloropropylene	µg/kg	142	157	104 - 220	Acceptable	EPA 8260B
4765	Ethylbenzene	µg/kg	60.5	71.7	39.1 - 104	Acceptable	EPA 8260B
4860	2-Hexanone	µg/kg	308	363	83.6 - 602	Acceptable	EPA 8260B
4900	Isopropylbenzene	µg/kg	0	0.00		Acceptable	EPA 8260B
4975	Methylene chloride	µg/kg	107	123	57.4 - 178	Acceptable	EPA 8260B
4995	4-Methyl-2-pentanone (MIBK)	µg/kg	99.3	113	47.2 - 168	Acceptable	EPA 8260B
5005	Naphthalene	µg/kg	79.8	85.2	40.3 - 123	Acceptable	EPA 8260B
5100	Styrene	µg/kg	0	0.00		Acceptable	EPA 8260B
5105	1,1,1,2-Tetrachloroethane	µg/kg	155	165	108 - 223	Acceptable	EPA 8260B
5110	1,1,2,2-Tetrachloroethane	µg/kg	0	0.00		Acceptable	EPA 8260B
5115	Tetrachloroethylene	µg/kg	149	184	83.1 - 266	Acceptable	EPA 8260B
5140	Toluene	µg/kg	76.8	84.0	48.0 - 118	Acceptable	EPA 8260B
5155	1,2,4-Trichlorobenzene	µg/kg	140	171	84.6 - 246	Acceptable	EPA 8260B
5160	1,1,1-Trichloroethane	µg/kg	133	136	77.5 - 194	Acceptable	EPA 8260B
5165	1,1,2-Trichloroethane	µg/kg	0	0.00		Acceptable	EPA 8260B
5170	Trichloroethylene	µg/kg	130	140	72.0 - 200	Acceptable	EPA 8260B
5175	Trichlorofluoromethane	µg/kg	91.1	97.9	56.2 - 163	Acceptable	EPA 8260B
5180	1,2,3-Trichloropropane (TCP)	µg/kg	77.3	86.4	33.5 - 144	Acceptable	EPA 8260B
5225	Vinyl acetate	µg/kg	0	0.00		Acceptable	EPA 8260B
5235	Vinyl chloride	µg/kg	0	0.00		Acceptable	EPA 8260B
5260	Xylenes, total	µg/kg	119	137	66.5 - 203	Acceptable	EPA 8260B
SOIL Low-Level PAHs in Soil (cat# 625)							
5500	Acenaphthene	µg/kg	476	804	127 - 977	Acceptable	EPA 8270 SIM
5505	Acenaphthylene	µg/kg	531	888	88.8 - 1280	Acceptable	EPA 8270 SIM
5555	Anthracene	µg/kg	256	421	62.5 - 581	Acceptable	EPA 8270 SIM
5575	Benzo(a)anthracene	µg/kg	207	337	111 - 445	Acceptable	EPA 8270 SIM
5585	Benzo(b)fluoranthene	µg/kg	274	459	169 - 551	Acceptable	EPA 8270 SIM
5600	Benzo(k)fluoranthene	µg/kg	313	494	152 - 623	Acceptable	EPA 8270 SIM
5590	Benzo(g,h,i)perylene	µg/kg	235	352	35.2 - 540	Acceptable	EPA 8270 SIM
5580	Benzo(a)pyrene	µg/kg	55.9	69.6	9.64 - 96.6	Acceptable	EPA 8270 SIM
5855	Chrysene	µg/kg	116	178	40.1 - 254	Acceptable	EPA 8270 SIM
5895	Dibenz(a,h)anthracene	µg/kg	147	194	51.1 - 306	Acceptable	EPA 8270 SIM
6265	Fluoranthene	µg/kg	197	334	104 - 462	Acceptable	EPA 8270 SIM
6270	Fluorene	µg/kg	144	246	44.7 - 337	Acceptable	EPA 8270 SIM
6315	Indeno(1,2,3-cd)pyrene	µg/kg	291	465	86.2 - 673	Acceptable	EPA 8270 SIM
5005	Naphthalene	µg/kg	281	501	50.1 - 652	Acceptable	EPA 8270 SIM
6615	Phenanthrene	µg/kg	321	540	144 - 668	Acceptable	EPA 8270 SIM
6665	Pyrene	µg/kg	178	283	78.3 - 375	Acceptable	EPA 8270 SIM

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SOIL-70 Final Complete Report

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2235 Route 130
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EPA ID: NJ00141
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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Low-Level PAHs in Soil (cat# 625)							
5500	Acenaphthene	µg/kg	390	804	127 - 977	Acceptable	EPA 8310 UV
5505	Acenaphthylene	µg/kg	452	888	88.8 - 1280	Acceptable	EPA 8310 UV
5555	Anthracene	µg/kg	254	421	62.5 - 581	Acceptable	EPA 8310 UV
5575	Benzo(a)anthracene	µg/kg	222	337	111 - 445	Acceptable	EPA 8310 UV
5585	Benzo(b)fluoranthene	µg/kg	297	459	169 - 551	Acceptable	EPA 8310 UV
5600	Benzo(k)fluoranthene	µg/kg	324	494	152 - 623	Acceptable	EPA 8310 UV
5590	Benzo(g,h,i)perylene	µg/kg	234	352	35.2 - 540	Acceptable	EPA 8310 UV
5580	Benzo(a)pyrene	µg/kg	39.6	69.6	9.64 - 96.6	Acceptable	EPA 8310 UV
5855	Chrysene	µg/kg	118	178	40.1 - 254	Acceptable	EPA 8310 UV
5895	Dibenz(a,h)anthracene	µg/kg	135	194	51.1 - 306	Acceptable	EPA 8310 UV
6265	Fluoranthene	µg/kg	223	334	104 - 462	Acceptable	EPA 8310 UV
6270	Fluorene	µg/kg	147	246	44.7 - 337	Acceptable	EPA 8310 UV
6315	Indeno(1,2,3-cd)pyrene	µg/kg	327	465	86.2 - 673	Acceptable	EPA 8310 UV
5005	Naphthalene	µg/kg	318	501	50.1 - 652	Acceptable	EPA 8310 UV
6615	Phenanthrene	µg/kg	353	540	144 - 668	Acceptable	EPA 8310 UV
6665	Pyrene	µg/kg	206	283	78.3 - 375	Acceptable	EPA 8310 UV
SOIL Low-Level PAHs in Soil (cat# 625)							
5500	Acenaphthene	µg/kg	731	804	127 - 977	Acceptable	EPA 8100
5505	Acenaphthylene	µg/kg	774	888	88.8 - 1280	Acceptable	EPA 8100
5555	Anthracene	µg/kg	343	421	62.5 - 581	Acceptable	EPA 8100
5575	Benzo(a)anthracene	µg/kg	281	337	111 - 445	Acceptable	EPA 8100
5585	Benzo(b)fluoranthene	µg/kg	392	459	169 - 551	Acceptable	EPA 8100
5600	Benzo(k)fluoranthene	µg/kg	447	494	152 - 623	Acceptable	EPA 8100
5590	Benzo(g,h,i)perylene	µg/kg	277	352	35.2 - 540	Acceptable	EPA 8100
5580	Benzo(a)pyrene	µg/kg	48.6	69.6	9.64 - 96.6	Acceptable	EPA 8100
5855	Chrysene	µg/kg	180	178	40.1 - 254	Acceptable	EPA 8100
5895	Dibenz(a,h)anthracene	µg/kg	199	194	51.1 - 306	Acceptable	EPA 8100
6265	Fluoranthene	µg/kg	309	334	104 - 462	Acceptable	EPA 8100
6270	Fluorene	µg/kg	208	246	44.7 - 337	Acceptable	EPA 8100
6315	Indeno(1,2,3-cd)pyrene	µg/kg	389	465	86.2 - 673	Acceptable	EPA 8100
5005	Naphthalene	µg/kg	400	501	50.1 - 652	Acceptable	EPA 8100
6615	Phenanthrene	µg/kg	496	540	144 - 668	Acceptable	EPA 8100
6665	Pyrene	µg/kg	260	283	78.3 - 375	Acceptable	EPA 8100

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Base/Neutrals and Acids in Soil (cat# 467)							
5500	Acenaphthene	µg/kg	3300	5590	1430 - 6580	Acceptable	EPA 8270C
5505	Acenaphthylene	µg/kg	1550	2490	477 - 3080	Acceptable	EPA 8270C
5145	2-Amino-1-methylbenzene (o-toluidine)	µg/kg	0	0.00		Acceptable	EPA 8270C
5545	Aniline	µg/kg	0	0.00		Acceptable	EPA 8270C
5555	Anthracene	µg/kg	1470	2240	476 - 3020	Acceptable	EPA 8270C
5595	Benzidine	µg/kg	0	0.00		Acceptable	EPA 8270C
5610	Benzoic acid	µg/kg	0	0.00		Acceptable	EPA 8270C
5575	Benzo(a)anthracene	µg/kg	1030	1900	478 - 2290	Acceptable	EPA 8270C
5585	Benzo(b)fluoranthene	µg/kg	0	0.00		Acceptable	EPA 8270C
5600	Benzo(k)fluoranthene	µg/kg	0	0.00		Acceptable	EPA 8270C
5590	Benzo(g,h,i)perylene	µg/kg	3640	6690	1440 - 8470	Acceptable	EPA 8270C
5580	Benzo(a)pyrene	µg/kg	1050	1610	365 - 2090	Acceptable	EPA 8270C
5630	Benzyl alcohol	µg/kg	0	0.00		Acceptable	EPA 8270C
5760	bis(2-Chloroethoxy)methane	µg/kg	0	0.00		Acceptable	EPA 8270C
5765	bis(2-Chloroethyl)ether	µg/kg	0	0.00		Acceptable	EPA 8270C
5780	bis(2-Chloroisopropyl)ether	µg/kg	1960	3080	308 - 3880	Acceptable	EPA 8270C
5660	4-Bromophenyl-phenylether	µg/kg	0	0.00		Acceptable	EPA 8270C
5670	Butylbenzylphthalate	µg/kg	0	0.00		Acceptable	EPA 8270C
5680	Carbazole	µg/kg	0	0.00		Acceptable	EPA 8270C
5745	4-Chloroaniline	µg/kg	0	0.00		Acceptable	EPA 8270C
5700	4-Chloro-3-methylphenol	µg/kg	5820	10000	2840 - 11500	Acceptable	EPA 8270C
5790	1-Chloronaphthalene	µg/kg		0.00		Not Reported	
5795	2-Chloronaphthalene	µg/kg	4660	7330	1690 - 8960	Acceptable	EPA 8270C
5800	2-Chlorophenol	µg/kg	1790	3150	315 - 3780	Acceptable	EPA 8270C
5825	4-Chlorophenyl-phenylether	µg/kg	4090	6350	1800 - 8370	Acceptable	EPA 8270C
5855	Chrysene	µg/kg	1090	1640	498 - 2300	Acceptable	EPA 8270C
5895	Dibenz(a,h)anthracene	µg/kg	1340	1930	307 - 2960	Acceptable	EPA 8270C
5905	Dibenzofuran	µg/kg	0	0.00		Acceptable	EPA 8270C
5925	Di-n-butylphthalate	µg/kg	0	0.00		Acceptable	EPA 8270C
4610	1,2-Dichlorobenzene	µg/kg	0	0.00		Acceptable	EPA 8270C
4615	1,3-Dichlorobenzene	µg/kg	0	0.00		Acceptable	EPA 8270C
4620	1,4-Dichlorobenzene	µg/kg	4200	8010	801 - 8810	Acceptable	EPA 8270C

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Base/Neutrals and Acids in Soil (cat# 467) (Continued)							
5945	3,3'-Dichlorobenzidine	µg/kg	0	0.00		Acceptable	EPA 8270C
6000	2,4-Dichlorophenol	µg/kg	6600	11900	2200 - 13600	Acceptable	EPA 8270C
6005	2,6-Dichlorophenol	µg/kg	0	0.00		Acceptable	EPA 8270C
6070	Diethylphthalate	µg/kg	6880	10800	2500 - 14600	Acceptable	EPA 8270C
6130	2,4-Dimethylphenol	µg/kg	0	0.00		Acceptable	EPA 8270C
6135	Dimethylphthalate	µg/kg	2260	3450	839 - 4630	Acceptable	EPA 8270C
6175	2,4-Dinitrophenol	µg/kg	0	6250	0.00 - 6880	Acceptable	EPA 8270C
6185	2,4-Dinitrotoluene	µg/kg	5040	8200	1700 - 11200	Acceptable	EPA 8270C
6190	2,6-Dinitrotoluene	µg/kg	6210	9070	2970 - 11200	Acceptable	EPA 8270C
6200	Di-n-octylphthalate	µg/kg	8550	11900	1870 - 17800	Acceptable	EPA 8270C
6065	bis(2-Ethylhexyl)phthalate	µg/kg	0	0.00		Acceptable	EPA 8270C
6265	Fluoranthene	µg/kg	1390	2180	661 - 2820	Acceptable	EPA 8270C
6270	Fluorene	µg/kg	0	0.00		Acceptable	EPA 8270C
6275	Hexachlorobenzene	µg/kg	5410	8900	2760 - 11000	Acceptable	EPA 8270C
4835	Hexachlorobutadiene	µg/kg	4490	7740	1140 - 8880	Acceptable	EPA 8270C
6285	Hexachlorocyclopentadiene	µg/kg	0	0.00		Acceptable	EPA 8270C
4840	Hexachloroethane	µg/kg	0	0.00		Acceptable	EPA 8270C
6315	Indeno(1,2,3-cd)pyrene	µg/kg	1420	2030	203 - 3250	Acceptable	EPA 8270C
6320	Isophorone	µg/kg	0	0.00		Acceptable	EPA 8270C
6360	4,6-Dinitro-2-methylphenol	µg/kg	0	0.00		Acceptable	EPA 8270C
6385	2-Methylnaphthalene	µg/kg	4060	6710	1520 - 7890	Acceptable	EPA 8270C
6400	2-Methylphenol	µg/kg	4560	11800	1180 - 13000	Acceptable	EPA 8270C
6410	3&4-Methylphenol	µg/kg	2950	6670	1180 - 7340	Acceptable	EPA 8270C
5005	Naphthalene	µg/kg	2060	3410	586 - 3960	Acceptable	EPA 8270C
6460	2-Nitroaniline	µg/kg	0	0.00		Acceptable	EPA 8270C
6465	3-Nitroaniline	µg/kg	0	0.00		Acceptable	EPA 8270C
6470	4-Nitroaniline	µg/kg	0	0.00		Acceptable	EPA 8270C
5015	Nitrobenzene	µg/kg	0	0.00		Acceptable	EPA 8270C
6490	2-Nitrophenol	µg/kg	6080	12000	1400 - 13400	Acceptable	EPA 8270C
6500	4-Nitrophenol	µg/kg	2780	8770	877 - 11500	Acceptable	EPA 8270C
6525	N-Nitrosodiethylamine	µg/kg	0	0.00		Acceptable	EPA 8270C
6530	N-Nitrosodimethylamine	µg/kg	4220	9190	973 - 10100	Acceptable	EPA 8270C

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Base/Neutrals and Acids in Soil (cat# 467) (Continued)							
6535	N-Nitrosodiphenylamine	µg/kg	0	0.00		Acceptable	EPA 8270C
6545	N-Nitroso-di-n-propylamine	µg/kg	8960	13800	1950 - 18000	Acceptable	EPA 8270C
6590	Pentachlorobenzene	µg/kg	0	0.00		Acceptable	EPA 8270C
6605	Pentachlorophenol	µg/kg	2030	9060	906 - 9970	Acceptable	EPA 8270C
6615	Phenanthrene	µg/kg	1830	2850	798 - 3750	Acceptable	EPA 8270C
6625	Phenol	µg/kg	6130	11500	1150 - 13900	Acceptable	EPA 8270C
6665	Pyrene	µg/kg	2090	3170	988 - 4280	Acceptable	EPA 8270C
5095	Pyridine	µg/kg	0	0.00		Acceptable	EPA 8270C
6715	1,2,4,5-Tetrachlorobenzene	µg/kg	0	0.00		Acceptable	EPA 8270C
6735	2,3,4,6-Tetrachlorophenol	µg/kg	0	0.00		Acceptable	EPA 8270C
5155	1,2,4-Trichlorobenzene	µg/kg	0	0.00		Acceptable	EPA 8270C
6835	2,4,5-Trichlorophenol	µg/kg	2590	4550	650 - 5650	Acceptable	EPA 8270C
6840	2,4,6-Trichlorophenol	µg/kg	4870	9650	2010 - 11200	Acceptable	EPA 8270C
SOIL Organochlorine Pesticides in Soil (cat# 468)							
7025	Aldrin	µg/kg	295	399	116 - 503	Acceptable	EPA 8081A
7110	alpha-BHC	µg/kg	243	354	102 - 458	Acceptable	EPA 8081A
7115	beta-BHC	µg/kg	38.5	57.3	5.73 - 103	Acceptable	EPA 8081A
7105	delta-BHC	µg/kg	210	311	75.9 - 423	Acceptable	EPA 8081A
7120	gamma-BHC(Lindane)	µg/kg	65.8	94.5	14.6 - 143	Acceptable	EPA 8081A
7240	alpha-Chlordane	µg/kg	67.4	95.4	31.3 - 135	Acceptable	EPA 8081A
7245	gamma-Chlordane	µg/kg	149	206	83.4 - 273	Acceptable	EPA 8081A
7355	4,4'-DDD	µg/kg	119	177	51.3 - 257	Acceptable	EPA 8081A
7360	4,4'-DDE	µg/kg	210	271	95.7 - 384	Acceptable	EPA 8081A
7365	4,4'-DDT	µg/kg	53.4	84.3	16.4 - 133	Acceptable	EPA 8081A
7470	Dieldrin	µg/kg	159	266	77.0 - 310	Acceptable	EPA 8081A
7540	Endrin	µg/kg	167	229	99.9 - 326	Acceptable	EPA 8081A
7530	Endrin aldehyde	µg/kg	118	312	35.6 - 393	Acceptable	EPA 8081A
7535	Endrin ketone	µg/kg	173	328	83.7 - 452	Acceptable	EPA 8081A
7510	Endosulfan I	µg/kg	61.2	184	19.8 - 202	Acceptable	EPA 8081A
7515	Endosulfan II	µg/kg	77.0	178	28.5 - 196	Acceptable	EPA 8081A
7520	Endosulfan sulfate	µg/kg	240	488	111 - 700	Acceptable	EPA 8081A
7685	Heptachlor	µg/kg	84.9	125	35.8 - 174	Acceptable	EPA 8081A
7690	Heptachlor epoxide	µg/kg	173	240	83.8 - 323	Acceptable	EPA 8081A
7810	Methoxychlor	µg/kg	143	235	23.5 - 413	Acceptable	EPA 8081A
SOIL Chlordane in Soil (cat# 628)							
7250	Chlordane, technical	µg/kg	568	497	99.9 - 676	Acceptable	EPA 8081A
SOIL Toxaphene in Soil (cat# 627)							
8250	Toxaphene	µg/kg	875	924	92.4 - 1350	Acceptable	EPA 8081A

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Chlorinated Acid Herbicides in Soil (cat# 626)							
8505	Acifluorfen	µg/kg		734	0.00 - 1090	Not Reported	
8530	Bentazon	µg/kg		0.00		Not Reported	
8540	Chloramben	µg/kg		362	0.00 - 398	Not Reported	
8545	2,4-D	µg/kg	152	374	37.4 - 620	Acceptable	EPA 8151A
8560	2,4-DB	µg/kg		784	0.00 - 1320	Not Reported	
8550	Dacthal diacid (DCPA)	µg/kg		0.00		Not Reported	
8555	Dalapon	µg/kg	16.1	0.00		Not Acceptable	EPA 8151A
8595	Dicamba	µg/kg	83.3	116	20.0 - 170	Acceptable	EPA 8151A
8600	3,5-Dichlorobenzoic acid	µg/kg		0.00		Not Reported	
8605	Dichlorprop	µg/kg	48.9	150	0.00 - 239	Acceptable	EPA 8151A
8620	Dinoseb	µg/kg	45.2	738	0.00 - 982	Acceptable	EPA 8151A
7775	MCPA	µg/kg	0	0.00		Acceptable	EPA 8151A
7780	MCPP	µg/kg	0	0.00		Acceptable	EPA 8151A
6500	4-Nitrophenol	µg/kg		144	35.4 - 199	Not Reported	
6605	Pentachlorophenol	µg/kg	112	477	0.00 - 678	Acceptable	EPA 8151A
8645	Picloram	µg/kg	0	0.00		Acceptable	EPA 8151A
8655	2,4,5-T	µg/kg	532	806	80.6 - 1250	Acceptable	EPA 8151A
8650	2,4,5-TP (Silvex)	µg/kg	279	433	43.3 - 722	Acceptable	EPA 8151A
SOIL PCBs in Soil (cat# 624)							
8880	Aroclor 1016	mg/kg	0	0.00		Acceptable	EPA 8082
8885	Aroclor 1221	mg/kg	0	0.00		Acceptable	EPA 8082
8890	Aroclor 1232	mg/kg	3.39	3.75	0.634 - 5.41	Acceptable	EPA 8082
8895	Aroclor 1242	mg/kg	0	0.00		Acceptable	EPA 8082
8900	Aroclor 1248	mg/kg	0	0.00		Acceptable	EPA 8082
8905	Aroclor 1254	mg/kg	0	0.00		Acceptable	EPA 8082
8910	Aroclor 1260	mg/kg	0	0.00		Acceptable	EPA 8082
SOIL Oil and Grease (O&G) in Soil (cat# 867)							
1860	n-Hexane Extractable Material(O&G)(Gravimet	mg/kg	1270	1320	386 - 2070	Acceptable	EPA 9071B
1860	n-Hexane Extractable Material(O&G)(IR)	mg/kg		1620	162 - 1780	Not Reported	
SOIL Gasoline Range Organics (GRO) in Soil (cat# 630)							
9408	Gasoline Range Organics (GRO)	mg/kg	1530	1570	286 - 2090	Acceptable	EPA 8015B
4375	Benzene in GRO	mg/kg		16.8	0.00 - 21.6	Not Reported	
4765	Ethylbenzene in GRO	mg/kg		50.4	28.6 - 62.2	Not Reported	
5140	Toluene in GRO	mg/kg		146	26.3 - 161	Not Reported	
5260	Xylenes, total in GRO	mg/kg		148	90.2 - 186	Not Reported	
SOIL Diesel Range Organics (DRO) in Soil (cat# 631)							
9369	Diesel Range Organics (DRO)	mg/kg	1560	1870	558 - 2220	Acceptable	EPA 8015B
SOIL Texas Low-Level Fuels (TPH) in Soil (cat# 478)							
2050	Total Petroleum Hydrocarbons	mg/kg	66.6	94.2	0.00 - 182	Acceptable	TNRCC 1005

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Texas High-Level Fuels (TPH) in Soil (cat# 479)							
2050	Total Petroleum Hydrocarbons	mg/kg	1080	1360	466 - 2160	Acceptable	TNRCC 1005

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ERA
A Waters Company

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SOIL-72™ Final Report

Soil/Hazardous Waste Proficiency Testing

Soil Study

Open Date: 10/18/10

Close Date: 12/02/10

Report Issued Date: 12/21/10

ERA
A Waters Company

December 21, 2010

Phillip Worby
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810

Enclosed is your final report for ERA's SOIL-72 Proficiency Testing (PT) study. Your final report includes an evaluation of all results submitted by your laboratory to ERA.

Data Evaluation Protocols: All analytes in ERA's SOIL-72 Proficiency Testing (PT) study have been evaluated using the following tiered approach. If the analyte is listed in the most current National Environmental Laboratory Accreditation Conference (NELAC) PT Field of Testing tables, the evaluation was completed by comparing the reported result to the acceptance limits generated using the criteria contained in the NELAC FoPT tables. If the analyte is not included in the NELAC FoPT tables, the reported result has been evaluated using the procedures outlined in ERA's Standard Operating Procedure for the Generation of Performance Acceptance Limits (SOP 0260).

Corrective Action Help: As part of your accreditation(s), you may be required to identify the root cause of any "Not Acceptable" results, implement the necessary corrective actions, and then satisfy your PT requirements by participating in a Supplemental (QuiK™ Response) or future ERA PT study. ERA's technical staff is available to help your laboratory resolve any technical issues that may be impairing your PT performance and possibly affecting your routine data quality. Our laboratory and technical staff have well over three hundred years of collective experience in performing the full range of environmental analyses. As part of our technical support, ERA offers QC samples that can be helpful in helping you work through your technical issues.

Thank you for your participation in ERA's SOIL-72 Proficiency Testing study. If you have any questions, please contact the proficiency testing department, or myself, at 1-800-372-0122.

Sincerely,

Jay R. McBurney
Quality Program Manager

attachments
jrm

6000 West 54th Ave., Arvada, CO 80002 800-372-0122 fax (303) 421-0159 www.eraqc.com

ERA
A Waters Company

Report Recipient	Contact/Phone Number	Reporting Type
Minnesota	Susan Wyatt / 651-201-5323	All Analytes
New Jersey	Rachel Ellis / 609-777-1749	All Analytes
Oklahoma	David Caldwell / 405-702-1039	All Analytes
South Carolina	Carol Smith / 803-896-0992	All Analytes
West Virginia (DEP)	Daniel T. Arnold / 304-926-0499 x1341	All Analytes
Enovis	Tim Abston / 313-872-6151	All Analytes
Laboratory Accreditation Bureau	Kelli Jannisch / 260 637 2705 ext 204	All Analytes

ERA
A Waters Company

SOIL-72 Definitions & Study Discussion

Study Dates: 10/18/10 - 12/02/10 **Report Issued: 12/21/10**

SOIL Study Definitions

The Reported Value is the value that the laboratory reported to ERA.

The ERA assigned value for the Organic Proficiency Testing Standards is equal to 100% of the parameter present in the standard as determined by gravimetric and/or volumetric measurements made during standard preparation as applicable. The ERA assigned value for the Inorganic Proficiency Testing Standards, with the exception of the TCLP Metals in Soil, is equal to the maximum amount of the parameter available in the standard by applicable EPA methodologies. The ERA assigned value for the TCLP metals is equal to the mean of ERA's internal analytical analyses. All NELAC parameters not added to a standard are given an assigned Value of "0", per the guidance issued by the NELAC Board of Directors, on December 14, 2000. Non-NELAC parameters not added to a standard may be given an assigned value of less than a minimum verified concentration as determined in the background soil for applicable EPA methodologies.

The Acceptance Limits are established per the NELAC PT program criteria or ERA's SOP for the Generation of Performance Acceptance Limits™ as applicable.

The Performance Evaluation:

Acceptable	= Reported Value falls within the Acceptance Limits.
Not Acceptable	= Reported Value falls outside the Acceptance Limits.
No Evaluation	= Reported Value cannot be evaluated.
Not Reported	= No Value reported.

The Method Description is the method the laboratory reported to ERA.

SOIL Study Discussion

ERA's SOIL-72 Proficiency Testing (PT) study has been reviewed by ERA senior management and certified compliant with the requirements of the National Environmental Laboratory Accreditation Conference (NELAC), Proficiency Testing Program Standards, Chapter 2, July 2003.

Per the requirements of the NELAC Proficiency Testing Program, a full review of all homogeneity, stability and accuracy verification data was completed. All analytical verification data for all analytes in the Soil study standards met the acceptance criteria contained in the NELAC Proficiency Testing Program Standards, Chapter 2, July 2003. If the analyte is included in the NELAC Fields of Testing list, the acceptance limits were calculated based on the NELAC Proficiency Testing Program Standards, Chapter 2, July 2003. If the analyte is not included in the NELAC Fields of Testing list, the acceptance limits were calculated using the procedures outlined in ERA's Standard Operating Procedure for the Generation of Performance Acceptance Limits (SOP 0260, Rev. 2.0).

The data submitted by participating laboratories was also examined for study anomalies. There were no anomalies observed during the statistical review of the data.

If you have any questions or concerns regarding your assessment in ERA's SOIL Proficiency Testing program, please contact Jay McBurney, Quality Program Manager, or the proficiency testing department at 1-800-372-0122.

ACCREDITED
Lab Code 1619-01

ERA
A Waters Company

Study: **SOIL-72**

ERA Customer Number: **A064801**

Laboratory Name: **Accutest Mid Atlantic**

Inorganic Results

ERA
A Waters Company

SOIL-72 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 12/21/10
Study Dates: 10/18/10 - 12/02/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Metals in Soil (cat# 620)							
1000	Aluminum	mg/kg	12300	10100	3410 - 13400	Acceptable	EPA 6010B
1005	Antimony	mg/kg	106	265	26.5 - 292	Acceptable	EPA 6010B
1010	Arsenic	mg/kg	112	133	75.9 - 146	Acceptable	EPA 6010B
1015	Barium	mg/kg	212	220	151 - 261	Acceptable	EPA 6010B
1020	Beryllium	mg/kg	90.5	97.1	65.6 - 111	Acceptable	EPA 6010B
1025	Boron	mg/kg	107	114	52.5 - 134	Acceptable	EPA 6010B
1030	Cadmium	mg/kg	80.5	89.6	58.7 - 102	Acceptable	EPA 6010B
1035	Calcium	mg/kg	7180	7020	4970 - 8430	Acceptable	EPA 6010B
1040	Chromium	mg/kg	131	129	81.6 - 152	Acceptable	EPA 6010B
1050	Cobalt	mg/kg	135	141	94.3 - 159	Acceptable	EPA 6010B
1055	Copper	mg/kg	116	132	87.4 - 146	Acceptable	EPA 6010B
1070	Iron	mg/kg	16200	15000	3760 - 20900	Acceptable	EPA 6010B
1075	Lead	mg/kg	80.0	83.4	52.3 - 100	Acceptable	EPA 6010B
1085	Magnesium	mg/kg	3010	2880	1690 - 3580	Acceptable	EPA 6010B
1090	Manganese	mg/kg	389	353	264 - 436	Acceptable	EPA 6010B
1095	Mercury	mg/kg		8.78	4.42 - 12.8	Not Reported	
1100	Molybdenum	mg/kg	64.9	77.9	40.9 - 85.7	Acceptable	EPA 6010B
1105	Nickel	mg/kg	73.3	80.6	50.6 - 91.8	Acceptable	EPA 6010B
1125	Potassium	mg/kg	3450	3300	1850 - 4080	Acceptable	EPA 6010B
1140	Selenium	mg/kg	130	144	84.6 - 170	Acceptable	EPA 6010B
1150	Silver	mg/kg	39.0	45.2	27.1 - 54.8	Acceptable	EPA 6010B
1155	Sodium	mg/kg	383	379	158 - 563	Acceptable	EPA 6010B
1160	Strontium	mg/kg	165	169	111 - 203	Acceptable	EPA 6010B
1165	Thallium	mg/kg	272	302	185 - 347	Acceptable	EPA 6010B
1175	Tin	mg/kg	138	148	76.6 - 183	Acceptable	EPA 6010B
1180	Titanium	mg/kg	403	254	0.00 - 460	Acceptable	EPA 6010B
1185	Vanadium	mg/kg	97.9	97.5	54.2 - 118	Acceptable	EPA 6010B
1190	Zinc	mg/kg	305	301	200 - 360	Acceptable	EPA 6010B

ACCREDITED Lab Code 1539-01

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

ERA
A Waters Company

SOIL-72 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 12/21/10
Study Dates: 10/18/10 - 12/02/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Metals in Soil (cat# 620)							
1000	Aluminum	mg/kg		10100	3410 - 13400	Not Reported	
1005	Antimony	mg/kg		265	26.5 - 292	Not Reported	
1010	Arsenic	mg/kg		133	75.9 - 146	Not Reported	
1015	Barium	mg/kg		220	151 - 261	Not Reported	
1020	Beryllium	mg/kg		97.1	65.6 - 111	Not Reported	
1025	Boron	mg/kg		114	52.5 - 134	Not Reported	
1030	Cadmium	mg/kg		89.6	58.7 - 102	Not Reported	
1035	Calcium	mg/kg		7020	4970 - 8430	Not Reported	
1040	Chromium	mg/kg		129	81.6 - 152	Not Reported	
1050	Cobalt	mg/kg		141	94.3 - 159	Not Reported	
1055	Copper	mg/kg		132	87.4 - 146	Not Reported	
1070	Iron	mg/kg		15000	3760 - 20900	Not Reported	
1075	Lead	mg/kg		83.4	52.3 - 100	Not Reported	
1085	Magnesium	mg/kg		2880	1690 - 3580	Not Reported	
1090	Manganese	mg/kg		353	264 - 436	Not Reported	
1095	Mercury	mg/kg	8.26	8.78	4.42 - 12.8	Acceptable	EPA 7471A
1100	Molybdenum	mg/kg		77.9	40.9 - 85.7	Not Reported	
1105	Nickel	mg/kg		80.6	50.6 - 91.8	Not Reported	
1125	Potassium	mg/kg		3300	1850 - 4080	Not Reported	
1140	Selenium	mg/kg		144	84.6 - 170	Not Reported	
1150	Silver	mg/kg		45.2	27.1 - 54.8	Not Reported	
1155	Sodium	mg/kg		379	158 - 563	Not Reported	
1160	Strontium	mg/kg		169	111 - 203	Not Reported	
1165	Thallium	mg/kg		302	185 - 347	Not Reported	
1175	Tin	mg/kg		148	76.6 - 183	Not Reported	
1180	Titanium	mg/kg		254	0.00 - 460	Not Reported	
1185	Vanadium	mg/kg		97.5	54.2 - 118	Not Reported	
1190	Zinc	mg/kg		301	200 - 360	Not Reported	

ACCREDITED Lab Code 1539-01

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

ERA
A Waters Company

SOIL-72 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
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2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 12/21/10
Study Dates: 10/18/10 - 12/02/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Metals in Soil (cat# 620)							
1000	Aluminum	mg/kg	12400	10100	3410 - 13400	Acceptable	EPA 6020A
1005	Antimony	mg/kg	117	265	26.5 - 292	Acceptable	EPA 6020A
1010	Arsenic	mg/kg	111	133	75.9 - 146	Acceptable	EPA 6020A
1015	Barium	mg/kg	219	220	151 - 261	Acceptable	EPA 6020A
1020	Beryllium	mg/kg	96.5	97.1	65.6 - 111	Acceptable	EPA 6020A
1025	Boron	mg/kg		114	52.5 - 134	Not Reported	
1030	Cadmium	mg/kg	80.8	89.6	58.7 - 102	Acceptable	EPA 6020A
1035	Calcium	mg/kg	6610	7020	4970 - 8430	Acceptable	EPA 6020A
1040	Chromium	mg/kg	114	129	81.6 - 152	Acceptable	EPA 6020A
1050	Cobalt	mg/kg	120	141	94.3 - 159	Acceptable	EPA 6020A
1055	Copper	mg/kg	113	132	87.4 - 146	Acceptable	EPA 6020A
1070	Iron	mg/kg	15500	15000	3760 - 20900	Acceptable	EPA 6020A
1075	Lead	mg/kg	77.2	83.4	52.3 - 100	Acceptable	EPA 6020A
1085	Magnesium	mg/kg	3050	2880	1690 - 3580	Acceptable	EPA 6020A
1090	Manganese	mg/kg	356	353	264 - 436	Acceptable	EPA 6020A
1095	Mercury	mg/kg		8.78	4.42 - 12.8	Not Reported	
1100	Molybdenum	mg/kg	65.3	77.9	40.9 - 85.7	Acceptable	EPA 6020A
1105	Nickel	mg/kg	67.9	80.6	50.6 - 91.8	Acceptable	EPA 6020A
1125	Potassium	mg/kg	3350	3300	1850 - 4080	Acceptable	EPA 6020A
1140	Selenium	mg/kg	132	144	84.6 - 170	Acceptable	EPA 6020A
1150	Silver	mg/kg	41.5	45.2	27.1 - 54.8	Acceptable	EPA 6020A
1155	Sodium	mg/kg	429	379	158 - 563	Acceptable	EPA 6020A
1160	Strontium	mg/kg	164	169	111 - 203	Acceptable	EPA 6020A
1165	Thallium	mg/kg	295	302	185 - 347	Acceptable	EPA 6020A
1175	Tin	mg/kg	134	148	76.6 - 183	Acceptable	EPA 6020A
1180	Titanium	mg/kg	341	254	0.00 - 460	Acceptable	EPA 6020A
1185	Vanadium	mg/kg	92.1	97.5	54.2 - 118	Acceptable	EPA 6020A
1190	Zinc	mg/kg	271	301	200 - 360	Acceptable	EPA 6020A
SOIL Hexavalent Chromium in Soil (cat# 876)							
1045	Chromium VI	mg/kg	85.8	140	28.0 - 172	Acceptable	EPA 7196A
SOIL Hexavalent Chromium in Soil (cat# 876)							
1045	Chromium VI	mg/kg	105	140	28.0 - 172	Acceptable	EPA 7199
SOIL Anions in Soil (cat# 873)							
1540	Bromide	mg/kg	171	124	74.9 - 141	Not Acceptable	EPA 9056
1575	Chloride	mg/kg	168	181	96.1 - 239	Acceptable	EPA 9056
1730	Fluoride	mg/kg	82.6	348	34.8 - 383	Acceptable	EPA 9056
1810	Nitrate as N	mg/kg		295	143 - 324	Not Reported	
1870	Phosphate as P	mg/kg		275	27.5 - 302	Not Reported	
2000	Sulfate	mg/kg	410	421	243 - 474	Acceptable	EPA 9056

ACCREDITED Lab Code: 1539-01

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

R2-0000967

ERA
A Waters Company

SOIL-72 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 12/21/10
Study Dates: 10/18/10 - 12/02/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Cyanide in Soil (cat# 621)							
1635	Cyanide, total	mg/kg	47.1	61.1	30.6 - 79.5	Acceptable	EPA 9012
1923	Reactive Cyanide	mg/kg		< 25.0		Not Reported	
SOIL Nutrients in Soil (cat# 869)							
1515	Ammonia as N	mg/kg		1140	606 - 1250	Not Reported	
1795	Total Kjeldahl Nitrogen	mg/kg		1390	644 - 1780	Not Reported	
2040	Total Organic Carbon (TOC)	mg/kg	1500	1950	195 - 4270	Acceptable	EPA 9060
1910	Total Phosphorus	mg/kg		441	44.1 - 838	Not Reported	
SOIL Corrosivity/pH in Soil (cat# 875)							
1625	Corrosivity (pH)	S.U.	7.11	7.31	6.71 - 7.91	Acceptable	EPA 9045C
SOIL Ignitability/Flashpoint (cat# 874)							
1780	Ignitability/Flashpoint	°F	114	111	94.0 - 128	Acceptable	EPA 1010A

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

R2-0000968

ERA
A Waters Company

Study: **SOIL-72**

ERA Customer Number: **A064801**

Laboratory Name: **Accutest Mid Atlantic**

Organic Results

ERA
A Waters Company

SOIL-72 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 12/21/10
Study Dates: 10/18/10 - 12/02/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Volatiles in Soil (cat# 623)							
4315	Acetone	µg/kg	518	351	40.0 - 579	Acceptable	EPA 8260B
4320	Acetonitrile	µg/kg	239	343	0.00 - 473	Acceptable	EPA 8260B
4325	Acrolein	µg/kg	< 50	0.00		Acceptable	EPA 8260B
4375	Benzene	µg/kg	90.0	117	70.2 - 160	Acceptable	EPA 8260B
4385	Bromobenzene	µg/kg	136	166	93.8 - 230	Acceptable	EPA 8260B
4395	Bromodichloromethane	µg/kg	77.0	87.5	56.0 - 121	Acceptable	EPA 8260B
4400	Bromoform	µg/kg	132	158	80.2 - 234	Acceptable	EPA 8260B
4950	Bromomethane	µg/kg	< 5.0	0.00		Acceptable	EPA 8260B
4410	2-Butanone (MEK)	µg/kg	336	309	95.2 - 484	Acceptable	EPA 8260B
5000	tert-Butyl methyl ether (MTBE)	µg/kg	111	136	57.4 - 201	Acceptable	EPA 8260B
4450	Carbon disulfide	µg/kg	< 5.0	0.00		Acceptable	EPA 8260B
4455	Carbon tetrachloride	µg/kg	< 5.0	0.00		Acceptable	EPA 8260B
4475	Chlorobenzene	µg/kg	120	141	79.8 - 195	Acceptable	EPA 8260B
4575	Chlorodibromomethane	µg/kg	133	164	101 - 225	Acceptable	EPA 8260B
4485	Chloroethane	µg/kg	< 5.0	0.00		Acceptable	EPA 8260B
4500	2-Chloroethylvinylether	µg/kg	< 25	0.00		Acceptable	EPA 8260B
4505	Chloroform	µg/kg	< 5.0	0.00		Acceptable	EPA 8260B
4960	Chloromethane	µg/kg	< 5.0	0.00		Acceptable	EPA 8260B
4570	1,2-Dibromo-3-chloropropane (DBCP)	µg/kg	138	164	76.0 - 271	Acceptable	EPA 8260B
4585	1,2-Dibromoethane (EDB)	µg/kg	72.7	83.1	60.3 - 104	Acceptable	EPA 8260B
4595	Dibromomethane	µg/kg	< 5.0	0.00		Acceptable	EPA 8260B
4610	1,2-Dichlorobenzene	µg/kg	< 5.0	0.00		Acceptable	EPA 8260B
4615	1,3-Dichlorobenzene	µg/kg	140	160	62.6 - 236	Acceptable	EPA 8260B
4620	1,4-Dichlorobenzene	µg/kg	< 5.0	0.00		Acceptable	EPA 8260B
4625	Dichlorodifluoromethane (Freon 12)	µg/kg	< 5.0	0.00		Acceptable	EPA 8260B
4630	1,1-Dichloroethane	µg/kg	110	136	77.3 - 196	Acceptable	EPA 8260B
4635	1,2-Dichloroethane	µg/kg	114	141	81.6 - 195	Acceptable	EPA 8260B
4640	1,1-Dichloroethylene	µg/kg	127	127	69.8 - 206	Acceptable	EPA 8260B
4645	cis-1,2-Dichloroethylene	µg/kg	144	160	106 - 219	Acceptable	EPA 8260B
4700	trans-1,2-Dichloroethylene	µg/kg	120	134	89.1 - 191	Acceptable	EPA 8260B
4655	1,2-Dichloropropane	µg/kg	119	154	90.0 - 206	Acceptable	EPA 8260B
4680	cis-1,3-Dichloropropylene	µg/kg	90.8	117	80.7 - 144	Acceptable	EPA 8260B

ACCREDITED Lab Code 1539-01

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

R2-0000970

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 12/21/10
Study Dates: 10/18/10 - 12/02/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Volatiles in Soil (cat# 623) (Continued)							
4685	trans-1,3-Dichloropropylene	µg/kg	< 5.0	0.00		Acceptable	EPA 8260B
4765	Ethylbenzene	µg/kg	93.6	120	66.8 - 172	Acceptable	EPA 8260B
4860	2-Hexanone	µg/kg	< 5.0	0.00		Acceptable	EPA 8260B
4900	Isopropylbenzene	µg/kg	134	186	87.0 - 295	Acceptable	EPA 8260B
4975	Methylene chloride	µg/kg	116	144	67.3 - 208	Acceptable	EPA 8260B
4995	4-Methyl-2-pentanone (MIBK)	µg/kg	115	138	58.8 - 204	Acceptable	EPA 8260B
5005	Naphthalene	µg/kg	57.5	63.9	26.9 - 93.8	Acceptable	EPA 8260B
5100	Styrene	µg/kg	< 5.0	0.00		Acceptable	EPA 8260B
5105	1,1,1,2-Tetrachloroethane	µg/kg	112	131	85.5 - 178	Acceptable	EPA 8260B
5110	1,1,2,2-Tetrachloroethane	µg/kg	126	161	84.0 - 233	Acceptable	EPA 8260B
5115	Tetrachloroethylene	µg/kg	< 5.0	0.00		Acceptable	EPA 8260B
5140	Toluene	µg/kg	126	157	90.6 - 220	Acceptable	EPA 8260B
5155	1,2,4-Trichlorobenzene	µg/kg	113	142	57.4 - 230	Acceptable	EPA 8260B
5160	1,1,1-Trichloroethane	µg/kg	116	146	83.4 - 208	Acceptable	EPA 8260B
5165	1,1,2-Trichloroethane	µg/kg	123	145	84.7 - 199	Acceptable	EPA 8260B
5170	Trichloroethylene	µg/kg	124	153	78.8 - 218	Acceptable	EPA 8260B
5175	Trichlorofluoromethane	µg/kg	< 5.0	0.00		Acceptable	EPA 8260B
5180	1,2,3-Trichloropropane (TCP)	µg/kg	114	142	55.5 - 207	Acceptable	EPA 8260B
5225	Vinyl acetate	µg/kg	< 10.0	0.00		Acceptable	EPA 8260B
5235	Vinyl chloride	µg/kg	< 5.0	0.00		Acceptable	EPA 8260B
5260	Xylenes, total	µg/kg	289	359	178 - 524	Acceptable	EPA 8260B

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 12/21/10
Study Dates: 10/18/10 - 12/02/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Volatiles in Soil (cat# 623)							
4315	Acetone	µg/kg		351	40.0 - 579	Not Reported	
4320	Acetonitrile	µg/kg		343	0.00 - 473	Not Reported	
4325	Acrolein	µg/kg		0.00		Not Reported	
4375	Benzene	µg/kg	113	117	70.2 - 160	Acceptable	EPA 8021B
4385	Bromobenzene	µg/kg		166	93.8 - 230	Not Reported	
4395	Bromodichloromethane	µg/kg		87.5	56.0 - 121	Not Reported	
4400	Bromoform	µg/kg		158	80.2 - 234	Not Reported	
4950	Bromomethane	µg/kg		0.00		Not Reported	
4410	2-Butanone (MEK)	µg/kg		309	95.2 - 484	Not Reported	
5000	tert-Butyl methyl ether (MTBE)	µg/kg	133	136	57.4 - 201	Acceptable	EPA 8021B
4450	Carbon disulfide	µg/kg		0.00		Not Reported	
4455	Carbon tetrachloride	µg/kg		0.00		Not Reported	
4475	Chlorobenzene	µg/kg	137	141	79.8 - 195	Acceptable	EPA 8021B
4575	Chlorodibromomethane	µg/kg		164	101 - 225	Not Reported	
4485	Chloroethane	µg/kg		0.00		Not Reported	
4500	2-Chloroethylvinylether	µg/kg		0.00		Not Reported	
4505	Chloroform	µg/kg		0.00		Not Reported	
4960	Chloromethane	µg/kg		0.00		Not Reported	
4570	1,2-Dibromo-3-chloropropane (DBCP)	µg/kg		164	76.0 - 271	Not Reported	
4585	1,2-Dibromoethane (EDB)	µg/kg		83.1	60.3 - 104	Not Reported	
4595	Dibromomethane	µg/kg		0.00		Not Reported	
4610	1,2-Dichlorobenzene	µg/kg	< 1.0	0.00		Acceptable	EPA 8021B
4615	1,3-Dichlorobenzene	µg/kg	156	160	62.6 - 236	Acceptable	EPA 8021B
4620	1,4-Dichlorobenzene	µg/kg	< 1.0	0.00		Acceptable	EPA 8021B
4625	Dichlorodifluoromethane (Freon 12)	µg/kg		0.00		Not Reported	
4630	1,1-Dichloroethane	µg/kg		136	77.3 - 196	Not Reported	
4635	1,2-Dichloroethane	µg/kg		141	81.6 - 195	Not Reported	
4640	1,1-Dichloroethylene	µg/kg		127	69.8 - 206	Not Reported	
4645	cis-1,2-Dichloroethylene	µg/kg	168	160	106 - 219	Acceptable	EPA 8021B
4700	trans-1,2-Dichloroethylene	µg/kg	131	134	89.1 - 191	Acceptable	EPA 8021B
4655	1,2-Dichloropropane	µg/kg		154	90.0 - 206	Not Reported	
4680	cis-1,3-Dichloropropylene	µg/kg	109	117	80.7 - 144	Acceptable	EPA 8021B

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Volatiles in Soil (cat# 623) (Continued)							
4685	trans-1,3-Dichloropropylene	µg/kg	< 1.0	0.00		Acceptable	EPA 8021B
4765	Ethylbenzene	µg/kg	115	120	66.8 - 172	Acceptable	EPA 8021B
4860	2-Hexanone	µg/kg		0.00		Not Reported	
4900	Isopropylbenzene	µg/kg	186	186	87.0 - 295	Acceptable	EPA 8021B
4975	Methylene chloride	µg/kg		144	67.3 - 208	Not Reported	
4995	4-Methyl-2-pentanone (MIBK)	µg/kg		138	58.8 - 204	Not Reported	
5005	Naphthalene	µg/kg	61.5	63.9	26.9 - 93.8	Acceptable	EPA 8021B
5100	Styrene	µg/kg	< 1.0	0.00		Acceptable	EPA 8021B
5105	1,1,1,2-Tetrachloroethane	µg/kg		131	85.5 - 178	Not Reported	
5110	1,1,2,2-Tetrachloroethane	µg/kg		161	84.0 - 233	Not Reported	
5115	Tetrachloroethylene	µg/kg	< 1.0	0.00		Acceptable	EPA 8021B
5140	Toluene	µg/kg	151	157	90.6 - 220	Acceptable	EPA 8021B
5155	1,2,4-Trichlorobenzene	µg/kg		142	57.4 - 230	Not Reported	
5160	1,1,1-Trichloroethane	µg/kg		146	83.4 - 208	Not Reported	
5165	1,1,2-Trichloroethane	µg/kg		145	84.7 - 199	Not Reported	
5170	Trichloroethylene	µg/kg	147	153	78.8 - 218	Acceptable	EPA 8021B
5175	Trichlorofluoromethane	µg/kg		0.00		Not Reported	
5180	1,2,3-Trichloropropane (TCP)	µg/kg		142	55.5 - 207	Not Reported	
5225	Vinyl acetate	µg/kg		0.00		Not Reported	
5235	Vinyl chloride	µg/kg		0.00		Not Reported	
5260	Xylenes, total	µg/kg	352	359	178 - 524	Acceptable	EPA 8021B
SOIL Low-Level PAHs in Soil (cat# 625)							
5500	Acenaphthene	µg/kg	539	746	111 - 874	Acceptable	EPA 8270 SIM
5505	Acenaphthylene	µg/kg	421	600	60.0 - 830	Acceptable	EPA 8270 SIM
5555	Anthracene	µg/kg	508	624	88.5 - 797	Acceptable	EPA 8270 SIM
5575	Benzo(a)anthracene	µg/kg	142	187	57.1 - 240	Acceptable	EPA 8270 SIM
5585	Benzo(b)fluoranthene	µg/kg	338	398	147 - 485	Acceptable	EPA 8270 SIM
5600	Benzo(k)fluoranthene	µg/kg	345	393	120 - 494	Acceptable	EPA 8270 SIM
5590	Benzo(g,h,i)perylene	µg/kg	115	141	20.0 - 205	Acceptable	EPA 8270 SIM
5580	Benzo(a)pyrene	µg/kg	173	235	42.8 - 297	Acceptable	EPA 8270 SIM
5855	Chrysene	µg/kg	143	216	45.6 - 288	Acceptable	EPA 8270 SIM
5895	Dibenz(a,h)anthracene	µg/kg	144	215	43.9 - 266	Acceptable	EPA 8270 SIM
6265	Fluoranthene	µg/kg	410	557	162 - 716	Acceptable	EPA 8270 SIM
6270	Fluorene	µg/kg	293	399	78.1 - 505	Acceptable	EPA 8270 SIM
6315	Indeno(1,2,3-cd)pyrene	µg/kg	69.4	76.2	13.6 - 126	Acceptable	EPA 8270 SIM
5005	Naphthalene	µg/kg	453	659	65.9 - 850	Acceptable	EPA 8270 SIM
6615	Phenanthrene	µg/kg	593	540	197 - 910	Acceptable	EPA 8270 SIM
6665	Pyrene	µg/kg	137	182	48.0 - 239	Acceptable	EPA 8270 SIM

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R2-0000973

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Low-Level PAHs in Soil (cat# 625)							
5500	Acenaphthene	µg/kg	526	746	111 - 874	Acceptable	EPA 8100
5505	Acenaphthylene	µg/kg	409	600	60.0 - 830	Acceptable	EPA 8100
5555	Anthracene	µg/kg	408	624	88.5 - 797	Acceptable	EPA 8100
5575	Benzo(a)anthracene	µg/kg	129	187	57.1 - 240	Acceptable	EPA 8100
5585	Benzo(b)fluoranthene	µg/kg	223	398	147 - 485	Acceptable	EPA 8100
5600	Benzo(k)fluoranthene	µg/kg	212	393	120 - 494	Acceptable	EPA 8100
5590	Benzo(g,h,i)perylene	µg/kg	99.4	141	20.0 - 205	Acceptable	EPA 8100
5580	Benzo(a)pyrene	µg/kg	147	235	42.8 - 297	Acceptable	EPA 8100
5855	Chrysene	µg/kg	147	216	45.6 - 288	Acceptable	EPA 8100
5895	Dibenz(a,h)anthracene	µg/kg	87.8	215	43.9 - 266	Acceptable	EPA 8100
6265	Fluoranthene	µg/kg	410	557	162 - 716	Acceptable	EPA 8100
6270	Fluorene	µg/kg	301	399	78.1 - 505	Acceptable	EPA 8100
6315	Indeno(1,2,3-cd)pyrene	µg/kg	96.9	76.2	13.6 - 126	Acceptable	EPA 8100
5005	Naphthalene	µg/kg	423	659	65.9 - 850	Acceptable	EPA 8100
6615	Phenanthrene	µg/kg	675	540	197 - 910	Acceptable	EPA 8100
6665	Pyrene	µg/kg	132	182	48.0 - 239	Acceptable	EPA 8100
SOIL Low-Level PAHs in Soil (cat# 625)							
5500	Acenaphthene	µg/kg	456	746	111 - 874	Acceptable	EPA 8310 UV
5505	Acenaphthylene	µg/kg	389	600	60.0 - 830	Acceptable	EPA 8310 UV
5555	Anthracene	µg/kg	458	624	88.5 - 797	Acceptable	EPA 8310 UV
5575	Benzo(a)anthracene	µg/kg	152	187	57.1 - 240	Acceptable	EPA 8310 UV
5585	Benzo(b)fluoranthene	µg/kg	312	398	147 - 485	Acceptable	EPA 8310 UV
5600	Benzo(k)fluoranthene	µg/kg	316	393	120 - 494	Acceptable	EPA 8310 UV
5590	Benzo(g,h,i)perylene	µg/kg	114	141	20.0 - 205	Acceptable	EPA 8310 UV
5580	Benzo(a)pyrene	µg/kg	160	235	42.8 - 297	Acceptable	EPA 8310 UV
5855	Chrysene	µg/kg	176	216	45.6 - 288	Acceptable	EPA 8310 UV
5895	Dibenz(a,h)anthracene	µg/kg	156	215	43.9 - 266	Acceptable	EPA 8310 UV
6265	Fluoranthene	µg/kg	449	557	162 - 716	Acceptable	EPA 8310 UV
6270	Fluorene	µg/kg	299	399	78.1 - 505	Acceptable	EPA 8310 UV
6315	Indeno(1,2,3-cd)pyrene	µg/kg	71.3	76.2	13.6 - 126	Acceptable	EPA 8310 UV
5005	Naphthalene	µg/kg	529	659	65.9 - 850	Acceptable	EPA 8310 UV
6615	Phenanthrene	µg/kg	569	540	197 - 910	Acceptable	EPA 8310 UV
6665	Pyrene	µg/kg	154	182	48.0 - 239	Acceptable	EPA 8310 UV

ACCREDITED Lab Code 1539-01

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

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SOIL-72 Final Complete Report

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Base/Neutrals and Acids in Soil (cat# 467)							
5500	Acenaphthene	µg/kg	3130	4510	1180 - 5630	Acceptable	EPA 8270C
5505	Acenaphthylene	µg/kg	< 29	0.00		Acceptable	EPA 8270C
5145	2-Amino-1-methylbenzene (o-toluidine)	µg/kg	< 140	0.00		Acceptable	EPA 8270C
5545	Aniline	µg/kg	< 57	0.00		Acceptable	EPA 8270C
5555	Anthracene	µg/kg	4270	6010	1510 - 7730	Acceptable	EPA 8270C
5595	Benzidine	µg/kg	< 570	0.00		Acceptable	EPA 8270C
5610	Benzoic acid	µg/kg	< 570	0.00		Acceptable	EPA 8270C
5575	Benzo(a)anthracene	µg/kg	2250	3460	1180 - 4750	Acceptable	EPA 8270C
5585	Benzo(b)fluoranthene	µg/kg	2760	3180	847 - 4450	Acceptable	EPA 8270C
5600	Benzo(k)fluoranthene	µg/kg	1250	1540	408 - 2070	Acceptable	EPA 8270C
5590	Benzo(g,h,i)perylene	µg/kg	3320	4950	1160 - 7030	Acceptable	EPA 8270C
5580	Benzo(a)pyrene	µg/kg	< 29	0.00		Acceptable	EPA 8270C
5630	Benzyl alcohol	µg/kg	< 57	0.00		Acceptable	EPA 8270C
5760	bis(2-Chloroethoxy)methane	µg/kg	3630	5930	1090 - 6970	Acceptable	EPA 8270C
5765	bis(2-Chloroethyl)ether	µg/kg	6720	12400	1500 - 14400	Acceptable	EPA 8270C
5780	bis(2-Chloroisopropyl)ether	µg/kg	< 57	0.00		Acceptable	EPA 8270C
5660	4-Bromophenyl-phenylether	µg/kg	7630	12700	4030 - 16600	Acceptable	EPA 8270C
5670	Butylbenzylphthalate	µg/kg	4970	11900	2810 - 17200	Acceptable	EPA 8270C
5680	Carbazole	µg/kg	< 57	0.00		Acceptable	EPA 8270C
5745	4-Chloroaniline	µg/kg	< 140	0.00		Acceptable	EPA 8270C
5700	4-Chloro-3-methylphenol	µg/kg	6890	10700	3090 - 12300	Acceptable	EPA 8270C
5790	1-Chloronaphthalene	µg/kg	< 140	0.00		Acceptable	EPA 8270C
5795	2-Chloronaphthalene	µg/kg	1370	2220	425 - 2910	Acceptable	EPA 8270C
5800	2-Chlorophenol	µg/kg	7070	11800	2020 - 13000	Acceptable	EPA 8270C
5825	4-Chlorophenyl-phenylether	µg/kg	4090	6430	1790 - 8340	Acceptable	EPA 8270C
5855	Chrysene	µg/kg	1180	1570	454 - 2110	Acceptable	EPA 8270C
5895	Dibenz(a,h)anthracene	µg/kg	1700	2010	389 - 3240	Acceptable	EPA 8270C
5905	Dibenzofuran	µg/kg	6570	10700	2880 - 13300	Acceptable	EPA 8270C
5925	Di-n-butylphthalate	µg/kg	< 57	0.00		Acceptable	EPA 8270C
4610	1,2-Dichlorobenzene	µg/kg	4230	8780	878 - 9660	Acceptable	EPA 8270C
4615	1,3-Dichlorobenzene	µg/kg	3480	8440	844 - 9280	Acceptable	EPA 8270C
4620	1,4-Dichlorobenzene	µg/kg	< 57	0.00		Acceptable	EPA 8270C

ACCREDITED Lab Code 1539-01

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Base/Neutrals and Acids in Soil (cat# 467) (Continued)							
5945	3,3'-Dichlorobenzidine	µg/kg	< 140	0.00		Acceptable	EPA 8270C
6000	2,4-Dichlorophenol	µg/kg	< 140	0.00		Acceptable	EPA 8270C
6005	2,6-Dichlorophenol	µg/kg	3440	5900	1650 - 6490	Acceptable	EPA 8270C
6070	Diethylphthalate	µg/kg	5510	8800	1990 - 11900	Acceptable	EPA 8270C
6130	2,4-Dimethylphenol	µg/kg	< 140	0.00		Acceptable	EPA 8270C
6135	Dimethylphthalate	µg/kg	5740	8920	2660 - 11300	Acceptable	EPA 8270C
6175	2,4-Dinitrophenol	µg/kg	< 570	0.00		Acceptable	EPA 8270C
6185	2,4-Dinitrotoluene	µg/kg	3450	4950	812 - 6780	Acceptable	EPA 8270C
6190	2,6-Dinitrotoluene	µg/kg	< 57	0.00		Acceptable	EPA 8270C
6200	Di-n-octylphthalate	µg/kg	< 57	0.00		Acceptable	EPA 8270C
6065	bis(2-Ethylhexyl)phthalate	µg/kg	6330	12000	3400 - 16800	Acceptable	EPA 8270C
6265	Fluoranthene	µg/kg	5160	8300	2840 - 10800	Acceptable	EPA 8270C
6270	Fluorene	µg/kg	4070	6300	2080 - 7970	Acceptable	EPA 8270C
6275	Hexachlorobenzene	µg/kg	< 57	0.00		Acceptable	EPA 8270C
4835	Hexachlorobutadiene	µg/kg	< 29	0.00		Acceptable	EPA 8270C
6285	Hexachlorocyclopentadiene	µg/kg	< 570	0.00		Acceptable	EPA 8270C
4840	Hexachloroethane	µg/kg	5380	12800	439 - 14100	Acceptable	EPA 8270C
6315	Indeno(1,2,3-cd)pyrene	µg/kg	4180	6820	682 - 10100	Acceptable	EPA 8270C
6320	Isophorone	µg/kg	< 57	0.00		Acceptable	EPA 8270C
6360	4,6-Dinitro-2-methylphenol	µg/kg	707	6140	0.00 - 6750	Acceptable	EPA 8270C
6385	2-Methylnaphthalene	µg/kg	2150	3610	931 - 4260	Acceptable	EPA 8270C
6400	2-Methylphenol	µg/kg	4130	10000	1000 - 11000	Acceptable	EPA 8270C
6412	3&4-Methylphenol	µg/kg	5400	11500	1920 - 12600	Acceptable	EPA 8270C
5005	Naphthalene	µg/kg	1940	3330	589 - 3980	Acceptable	EPA 8270C
6460	2-Nitroaniline	µg/kg	< 140	0.00		Acceptable	EPA 8270C
6465	3-Nitroaniline	µg/kg	< 140	0.00		Acceptable	EPA 8270C
6470	4-Nitroaniline	µg/kg	< 140	0.00		Acceptable	EPA 8270C
5015	Nitrobenzene	µg/kg	< 57	0.00		Acceptable	EPA 8270C
6490	2-Nitrophenol	µg/kg	6530	10500	1200 - 11900	Acceptable	EPA 8270C
6500	4-Nitrophenol	µg/kg	2700	5040	600 - 6780	Acceptable	EPA 8270C
6525	N-Nitrosodiethylamine	µg/kg	< 140	0.00		Acceptable	EPA 8270C
6530	N-Nitrosodimethylamine	µg/kg	5040	11000	1880 - 12100	Acceptable	EPA 8270C

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Base/Neutrals and Acids in Soil (cat# 467) (Continued)							
6535	N-Nitrosodiphenylamine	µg/kg	< 140	0.00		Acceptable	EPA 8270C
6545	N-Nitroso-di-n-propylamine	µg/kg	6210	9100	1180 - 12200	Acceptable	EPA 8270C
6590	Pentachlorobenzene	µg/kg	< 140	0.00		Acceptable	EPA 8270C
6605	Pentachlorophenol	µg/kg	1410	3850	600 - 4310	Acceptable	EPA 8270C
6615	Phenanthrene	µg/kg	< 29	0.00		Acceptable	EPA 8270C
6625	Phenol	µg/kg	5590	8600	860 - 10500	Acceptable	EPA 8270C
6665	Pyrene	µg/kg	1560	2230	701 - 3100	Acceptable	EPA 8270C
5095	Pyridine	µg/kg	< 57	0.00		Acceptable	EPA 8270C
6715	1,2,4,5-Tetrachlorobenzene	µg/kg	< 140	0.00		Acceptable	EPA 8270C
6735	2,3,4,6-Tetrachlorophenol	µg/kg	< 140	0.00		Acceptable	EPA 8270C
5155	1,2,4-Trichlorobenzene	µg/kg	2030	3570	531 - 4210	Acceptable	EPA 8270C
6835	2,4,5-Trichlorophenol	µg/kg	5740	9900	1520 - 12000	Acceptable	EPA 8270C
6840	2,4,6-Trichlorophenol	µg/kg	3330	5460	977 - 6590	Acceptable	EPA 8270C
SOIL Organochlorine Pesticides in Soil (cat# 468)							
7025	Aldrin	µg/kg	119	181	49.8 - 232	Acceptable	EPA 8081A
7110	alpha-BHC	µg/kg	246	363	101 - 455	Acceptable	EPA 8081A
7115	beta-BHC	µg/kg	137	220	39.1 - 313	Acceptable	EPA 8081A
7105	delta-BHC	µg/kg	225	410	97.0 - 519	Acceptable	EPA 8081A
7120	gamma-BHC(Lindane)	µg/kg	300	464	124 - 564	Acceptable	EPA 8081A
7240	alpha-Chlordane	µg/kg	47.9	78.5	24.7 - 110	Acceptable	EPA 8081A
7245	gamma-Chlordane	µg/kg	135	209	80.0 - 263	Acceptable	EPA 8081A
7355	4,4'-DDD	µg/kg	257	383	130 - 500	Acceptable	EPA 8081A
7360	4,4'-DDE	µg/kg	253	322	114 - 447	Acceptable	EPA 8081A
7365	4,4'-DDT	µg/kg	111	196	43.7 - 272	Acceptable	EPA 8081A
7470	Dieldrin	µg/kg	203	326	110 - 411	Acceptable	EPA 8081A
7540	Endrin	µg/kg	60.8	95.4	29.0 - 148	Acceptable	EPA 8081A
7530	Endrin aldehyde	µg/kg	82.2	306	30.6 - 361	Acceptable	EPA 8081A
7535	Endrin ketone	µg/kg	133	351	84.7 - 457	Acceptable	EPA 8081A
7510	Endosulfan I	µg/kg	64.7	220	31.5 - 242	Acceptable	EPA 8081A
7515	Endosulfan II	µg/kg	66.6	242	40.3 - 266	Acceptable	EPA 8081A
7520	Endosulfan sulfate	µg/kg	161	439	95.0 - 608	Acceptable	EPA 8081A
7685	Heptachlor	µg/kg	226	347	97.2 - 438	Acceptable	EPA 8081A
7690	Heptachlor epoxide	µg/kg	204	315	104 - 396	Acceptable	EPA 8081A
7810	Methoxychlor	µg/kg	199	403	45.4 - 621	Acceptable	EPA 8081A
SOIL Chlordane in Soil (cat# 628)							
7250	Chlordane, technical	µg/kg	312	622	126 - 835	Acceptable	EPA 8081A
SOIL Toxaphene in Soil (cat# 627)							
8250	Toxaphene	µg/kg	560	723	72.3 - 1040	Acceptable	EPA 8081A

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
SOIL Chlorinated Acid Herbicides in Soil (cat# 626)							
8505	Acifluorfen	µg/kg		0.00		Not Reported	
8530	Bentazon	µg/kg		335	1.66 - 454	Not Reported	
8540	Chloramben	µg/kg		0.00		Not Reported	
8545	2,4-D	µg/kg	204	628	62.8 - 1010	Acceptable	EPA 8151A
8560	2,4-DB	µg/kg	238	980	0.00 - 1530	Acceptable	EPA 8151A
8550	Dacthal diacid (DCPA)	µg/kg		0.00		Not Reported	
8555	Dalapon	µg/kg	< 3.3	0.00		Acceptable	EPA 8151A
8595	Dicamba	µg/kg	204	309	30.9 - 523	Acceptable	EPA 8151A
8600	3,5-Dichlorobenzoic acid	µg/kg		194	0.00 - 227	Not Reported	
8605	Dichlorprop	µg/kg	< 17	113	0.00 - 177	Acceptable	EPA 8151A
8620	Dinoseb	µg/kg	55.7	612	0.00 - 868	Acceptable	EPA 8151A
7775	MCPA	µg/kg	< 1700	0.00		Acceptable	EPA 8151A
7780	MCPP	µg/kg	< 1700	0.00		Acceptable	EPA 8151A
6500	4-Nitrophenol	µg/kg	<	189	15.9 - 208	No Evaluation	EPA 8151A
6605	Pentachlorophenol	µg/kg	< 91.9	191	0.00 - 236	Acceptable	EPA 8151A
8645	Picloram	µg/kg	< 17	141	0.00 - 182	Acceptable	EPA 8151A
8655	2,4,5-T	µg/kg	237	366	36.6 - 588	Acceptable	EPA 8151A
8650	2,4,5-TP (Silvex)	µg/kg	182	242	24.2 - 357	Acceptable	EPA 8151A
SOIL PCBs in Soil (cat# 624)							
8880	Aroclor 1016	mg/kg	< .029	0.00		Acceptable	EPA 8082
8885	Aroclor 1221	mg/kg	< .029	0.00		Acceptable	EPA 8082
8890	Aroclor 1232	mg/kg	< .029	0.00		Acceptable	EPA 8082
8895	Aroclor 1242	mg/kg	7.51	12.2	3.00 - 17.5	Acceptable	EPA 8082
8900	Aroclor 1248	mg/kg	< .029	0.00		Acceptable	EPA 8082
8905	Aroclor 1254	mg/kg	< .029	0.00		Acceptable	EPA 8082
8910	Aroclor 1260	mg/kg	< .029	0.00		Acceptable	EPA 8082
SOIL Oil and Grease (O&G) in Soil (cat# 867)							
1860	n-Hexane Extractable Material(O&G)(Gravimet	mg/kg	1220	1190	364 - 2010	Acceptable	EPA 9071B
1860	n-Hexane Extractable Material(O&G)(IR)	mg/kg		1460	577 - 2600	Not Reported	
SOIL Gasoline Range Organics (GRO) in Soil (cat# 630)							
9408	Gasoline Range Organics (GRO)	mg/kg	315	409	40.9 - 688	Acceptable	EPA 8015B
4375	Benzene in GRO	mg/kg		4.37	0.00 - 5.21	Not Reported	
4765	Ethylbenzene in GRO	mg/kg		13.1	5.13 - 15.4	Not Reported	
5140	Toluene in GRO	mg/kg		38.1	0.00 - 41.9	Not Reported	
5260	Xylenes, total in GRO	mg/kg		38.6	9.58 - 52.2	Not Reported	
SOIL Diesel Range Organics (DRO) in Soil (cat# 631)							
9369	Diesel Range Organics (DRO)	mg/kg	568	742	174 - 932	Acceptable	EPA 8015B

ACCREDITED Lab Code: 1539-01

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

Phillip Worby
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810

WP-180 Final Report

WatR™ Pollution Proficiency Testing

WatR™ Pollution Study

Open Date: 01/18/10

Close Date: 03/04/10

Report Issued Date: 03/23/10

March 23, 2010

Phillip Worby
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810

Enclosed is your final report for ERA's WP-180 WatR™Pollution Proficiency Testing (PT) study. Your final report includes an evaluation of all results submitted by your laboratory to ERA.

Data Evaluation Protocols: All analytes in ERA's WP-180 WatR™Pollution Proficiency Testing study have been evaluated using the following tiered approach. If the analyte is listed in the most current National Environmental Laboratory Accreditation Conference (NELAC) PT Field of Testing tables, the evaluation was completed by comparing the reported result to the acceptance limits generated using the criteria contained in the NELAC FoPT tables. If the analyte is not included in the NELAC FoPT tables, the reported result has been evaluated using the procedures outlined in ERA's Standard Operating Procedure for the Generation of Performance Acceptance Limits (SOP 0260).

Corrective Action Help: As part of your accreditation(s), you may be required to identify the root cause of any "Not Acceptable" results, implement the necessary corrective actions, and then satisfy your PT requirements by participating in a Supplemental (QuiK™ Response) or future ERA PT study. ERA's technical staff is available to help your laboratory resolve any technical issues that may be impairing your PT performance and possibly affecting your routine data quality. Our laboratory and technical staff have well over three hundred years of collective experience in performing the full range of environmental analyses. As part of our technical support, ERA offers QC samples that can be helpful in helping you work through your technical issues.

Thank you for your participation in ERA's WP-180 WatR™Pollution Proficiency Testing study. If you have any questions, please contact myself, or Curtis Wood, Director of Regulatory Affairs and Business Development, at 1-800-372-0122.

Sincerely,

Shawn Kassner
Proficiency Testing Manager

Jay R. McBurney
Quality Program Manager

attachments
smk

Report Recipient	Contact/Phone Number	Reporting Type
DoD EDQW	Fred S McLean / 843-764-7266	All Analytes
Minnesota	Susan Wyatt / 651-201-5323	All Analytes
New Jersey	Rachel Ellis / 609-777-1749	All Analytes
North Carolina (WP)	Patrick Donnelly / 919-733-3908 x207	All Analytes
Ohio-VAP	Darlene Stanley / 614-644-3748	All Analytes
South Carolina	Carol Smith / 803-896-0992	All Analytes
West Virginia (DEP)	Daniel T. Arnold / 304-926-0499 x1341	All Analytes
Enovis	Tim Abston / 313-872-6151	All Analytes

WP-180 Definitions & Study Discussion

Study Dates: 01/18/10 - 03/04/10 **Report Issued: 03/23/10**

WP Study Definitions

The Reported Value is the value that the laboratory reported to ERA.

The ERA Assigned Values are compliant with the most current USEPA/NELAC FoPT tables. A parameter not added to the standard is given an Assigned Value of "0" per the guidelines contained in the USEPA's Criteria Document and NELAC standards.

The Acceptance Limits are established per the criteria contained in the most current USEPA/NELAC FoPT tables, or ERA's SOP for the Generation of Performance Acceptance Limits™ as applicable.

The Performance Evaluation:

Acceptable	= Reported Value falls within the Acceptance Limits.
Not Acceptable	= Reported Value falls outside the Acceptance Limits.
No Evaluation	= Reported Value cannot be evaluated.
Not Reported	= No Value reported.

The Method Description is the method the laboratory reported to ERA.

WP Study Discussion

ERA's WP-180 WatR™Pollution Proficiency Testing study has been reviewed by ERA senior management and certified compliant with the requirements of the USEPA's National Standards for Water Proficiency Testing Studies Criteria Document (December 1998), and the criteria contained in the most current NELAC FoPT tables.

ERA's WP-180 WatR™Pollution study standards were examined for any anomalies. A full review of all homogeneity, stability and accuracy verification data was completed. All analytical verification data for all analytes met the acceptance criteria contained in the USEPA's National Criteria Document for Water Proficiency Testing Studies, December 1998, and the criteria contained in the most current NELAC FoPT tables.

The data submitted by participating laboratories was also examined for study anomalies. There were no anomalies observed during the statistical review of the data.

If you have any questions or concerns regarding your assessment in ERA's WatR™Pollution Proficiency Testing program, please contact Shawn Kassner, Proficiency Testing Manager, or Curtis Wood, Director of Regulatory Affairs and Business Development, at 1-800-372-0122.

ACCREDITED
Lab Code: 1333-01

Study: **WP-180**

ERA Customer Number: **A064801**

Laboratory Name: **Accutest Mid Atlantic**

Inorganic Results

WP-180 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 03/23/10
Study Dates: 01/18/10 - 03/04/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Minerals (cat# 581)							
0027	Alkalinity as CaCO3	mg/L	55.2	55.8	48.5 - 63.1	Acceptable	SM2320B
0028	Chloride	mg/L	75.2	74.4	63.6 - 85.5	Acceptable	EPA 300.0
0020	Conductivity at 25°C	µmhos/cm	411	408	365 - 451	Acceptable	SM2510B
0029	Fluoride	mg/L	1.46	1.46	1.16 - 1.77	Acceptable	EPA 300.0
0026	Potassium	mg/L	18.9	18.9	15.5 - 22.6	Acceptable	EPA 200.7
0025	Sodium	mg/L	72.4	71.9	61.0 - 82.4	Acceptable	EPA 200.7
0030	Sulfate	mg/L	19.8	19.6	15.2 - 23.5	Acceptable	EPA 300.0
0021	Total Dissolved Solids at 180°C	mg/L	267	272	203 - 341	Acceptable	SM2540C
1950	Total Solids at 105°C	mg/L	269	283	243 - 319	Acceptable	SM2540B
WP Minerals (cat# 581)							
0027	Alkalinity as CaCO3	mg/L		55.8	48.5 - 63.1	Not Reported	
0028	Chloride	mg/L	75.2	74.4	63.6 - 85.5	Acceptable	EPA 9056
0020	Conductivity at 25°C	µmhos/cm	411	408	365 - 451	Acceptable	EPA 9050A
0029	Fluoride	mg/L	1.46	1.46	1.16 - 1.77	Acceptable	EPA 9056
0026	Potassium	mg/L	19.6	18.9	15.5 - 22.6	Acceptable	EPA 200.8
0025	Sodium	mg/L	73.6	71.9	61.0 - 82.4	Acceptable	EPA 200.8
0030	Sulfate	mg/L	19.8	19.6	15.2 - 23.5	Acceptable	EPA 9056
0021	Total Dissolved Solids at 180°C	mg/L		272	203 - 341	Not Reported	
1950	Total Solids at 105°C	mg/L	269	283	243 - 319	Acceptable	SM2540G
WP Minerals (cat# 581)							
0027	Alkalinity as CaCO3	mg/L		55.8	48.5 - 63.1	Not Reported	
0028	Chloride	mg/L	73.3	74.4	63.6 - 85.5	Acceptable	SM4500Cl- C VIS
0020	Conductivity at 25°C	µmhos/cm		408	365 - 451	Not Reported	
0029	Fluoride	mg/L		1.46	1.16 - 1.77	Not Reported	
0026	Potassium	mg/L	18.0	18.9	15.5 - 22.6	Acceptable	EPA 6010B
0025	Sodium	mg/L	70.0	71.9	61.0 - 82.4	Acceptable	EPA 6010B
0030	Sulfate	mg/L		19.6	15.2 - 23.5	Not Reported	
0021	Total Dissolved Solids at 180°C	mg/L		272	203 - 341	Not Reported	
1950	Total Solids at 105°C	mg/L		283	243 - 319	Not Reported	
WP Minerals (cat# 581)							
0027	Alkalinity as CaCO3	mg/L		55.8	48.5 - 63.1	Not Reported	
0028	Chloride	mg/L		74.4	63.6 - 85.5	Not Reported	
0020	Conductivity at 25°C	µmhos/cm		408	365 - 451	Not Reported	
0029	Fluoride	mg/L		1.46	1.16 - 1.77	Not Reported	
0026	Potassium	mg/L	19.3	18.9	15.5 - 22.6	Acceptable	EPA 6020
0025	Sodium	mg/L	74.7	71.9	61.0 - 82.4	Acceptable	EPA 6020
0030	Sulfate	mg/L		19.6	15.2 - 23.5	Not Reported	
0021	Total Dissolved Solids at 180°C	mg/L		272	203 - 341	Not Reported	
1950	Total Solids at 105°C	mg/L		283	243 - 319	Not Reported	

WP-180 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 03/23/10
Study Dates: 01/18/10 - 03/04/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Hardness (cat# 580)							
0072	Non-Filterable Residue (TSS)	mg/L	76.0	80.0	65.2 - 89.1	Acceptable	SM2540D
0023	Calcium	mg/L	36.2	37.3	33.2 - 42.4	Acceptable	EPA 200.7
0024	Magnesium	mg/L	15.2	15.3	13.1 - 17.6	Acceptable	EPA 200.7
1550	Calcium Hardness as CaCO3	mg/L	90.4	93.1	82.8 - 106	Acceptable	EPA 200.7
0022	Total Hardness as CaCO3	mg/L	153	156	137 - 178	Acceptable	EPA 200.7
WP Hardness (cat# 580)							
0072	Non-Filterable Residue (TSS)	mg/L		80.0	65.2 - 89.1	Not Reported	
0023	Calcium	mg/L	37.3	37.3	33.2 - 42.4	Acceptable	EPA 200.8
0024	Magnesium	mg/L	16.2	15.3	13.1 - 17.6	Acceptable	EPA 200.8
1550	Calcium Hardness as CaCO3	mg/L		93.1	82.8 - 106	Not Reported	
0022	Total Hardness as CaCO3	mg/L	160	156	137 - 178	Acceptable	SM2340C
WP Hardness (cat# 580)							
0072	Non-Filterable Residue (TSS)	mg/L		80.0	65.2 - 89.1	Not Reported	
0023	Calcium	mg/L	36.1	37.3	33.2 - 42.4	Acceptable	EPA 6010B
0024	Magnesium	mg/L	15.2	15.3	13.1 - 17.6	Acceptable	EPA 6010B
1550	Calcium Hardness as CaCO3	mg/L		93.1	82.8 - 106	Not Reported	
0022	Total Hardness as CaCO3	mg/L		156	137 - 178	Not Reported	
WP Hardness (cat# 580)							
0072	Non-Filterable Residue (TSS)	mg/L		80.0	65.2 - 89.1	Not Reported	
0023	Calcium	mg/L	36.8	37.3	33.2 - 42.4	Acceptable	EPA 6020
0024	Magnesium	mg/L	16.2	15.3	13.1 - 17.6	Acceptable	EPA 6020
1550	Calcium Hardness as CaCO3	mg/L		93.1	82.8 - 106	Not Reported	
0022	Total Hardness as CaCO3	mg/L		156	137 - 178	Not Reported	
WP pH (cat# 577)							
0019	pH	S.U.	7.22	7.24	7.04 - 7.44	Acceptable	SM4500H+ B
WP Settleable Solids (cat# 883)							
1965	Settleable Solids	mL/L	18.0	18.4	14.0 - 23.8	Acceptable	SM2540F
WP Volatile Solids (cat# 884)							
1970	Volatile Solids	mg/L	210	240	188 - 276	Acceptable	EPA 160.4
WP Volatile Solids (cat# 884)							
1970	Volatile Solids	mg/L	210	240	188 - 276	Acceptable	SM2540G
WP Simple Nutrients (cat# 584)							
0031	Ammonia as N	mg/L	8.50	10.7	7.93 - 13.3	Acceptable	SM4500NH3 G
1820	Nitrate + Nitrite as N	mg/L	20.7	21.9	17.8 - 25.4	Acceptable	EPA 353.2
0032	Nitrate as N	mg/L	20.7	21.9	17.1 - 26.4	Acceptable	EPA 353.2
0033	ortho-Phosphate as P	mg/L	2.96	2.98	2.43 - 3.55	Acceptable	SM4500P E

ACCREDITED LAB CODE 1539-01

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

WP-180 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 03/23/10
Study Dates: 01/18/10 - 03/04/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Complex Nutrients (cat# 579)							
0034	Total Kjeldahl Nitrogen	mg/L	8.07	8.02	5.37 - 10.5	Acceptable	EPA 351.2
0035	Total phosphorus as P	mg/L	1.49	1.39	1.09 - 1.74	Acceptable	EPA 365.3
WP Nitrite (cat# 888)							
1840	Nitrite as N	mg/L	2.16	2.11	1.77 - 2.45	Acceptable	SM4500NO2- B
WP Demand (cat# 578)							
0038	BOD	mg/L	61.3	75.3	38.0 - 113	Acceptable	SM5210B
0102	CBOD	mg/L	50.0	64.8	29.1 - 100	Acceptable	SM5210B
0036	COD	mg/L	110	122	92.0 - 141	Acceptable	SM5220C
0037	TOC	mg/L	42.0	48.2	40.2 - 55.6	Acceptable	SM5310B
WP Demand (cat# 578)							
0038	BOD	mg/L		75.3	38.0 - 113	Not Reported	
0102	CBOD	mg/L		64.8	29.1 - 100	Not Reported	
0036	COD	mg/L		122	92.0 - 141	Not Reported	
0037	TOC	mg/L	42.0	48.2	40.2 - 55.6	Acceptable	EPA 9060
WP Oil & Grease (cat# 582)							
0104	Oil & Grease (Gravimetric)	mg/L	39.7	45.0	28.3 - 55.5	Acceptable	EPA 1664A
1860	Oil & Grease (Infrared)	mg/L		55.4	36.4 - 67.0	Not Reported	
WP Trace Metals (cat# 586)							
0001	Aluminum	µg/L	1360	1410	1150 - 1660	Acceptable	EPA 200.7
0016	Antimony	µg/L	456	458	319 - 552	Acceptable	EPA 200.7
0002	Arsenic	µg/L	270	273	226 - 321	Acceptable	EPA 200.7
1015	Barium	µg/L	304	316	274 - 356	Acceptable	EPA 200.7
0003	Beryllium	µg/L	116	120	101 - 136	Acceptable	EPA 200.7
1025	Boron	µg/L	1620	1600	1300 - 1860	Acceptable	EPA 200.7
0004	Cadmium	µg/L	560	553	472 - 628	Acceptable	EPA 200.7
0006	Chromium	µg/L	823	813	709 - 919	Acceptable	EPA 200.7
0005	Cobalt	µg/L	763	744	654 - 834	Acceptable	EPA 200.7
0007	Copper	µg/L	703	764	688 - 840	Acceptable	EPA 200.7
0008	Iron	µg/L	1410	1400	1240 - 1580	Acceptable	EPA 200.7
0012	Lead	µg/L	355	367	317 - 415	Acceptable	EPA 200.7
0010	Manganese	µg/L	483	470	421 - 522	Acceptable	EPA 200.7
0074	Molybdenum	µg/L	85.6	88.5	69.8 - 106	Acceptable	EPA 200.7
0011	Nickel	µg/L	1520	1580	1420 - 1760	Acceptable	EPA 200.7
0013	Selenium	µg/L	1280	1300	1030 - 1500	Acceptable	EPA 200.7
0017	Silver	µg/L	205	209	179 - 240	Acceptable	EPA 200.7
0075	Strontium	µg/L	62.0	63.9	52.8 - 74.8	Acceptable	EPA 200.7
0018	Thallium	µg/L	516	529	426 - 635	Acceptable	EPA 200.7
0014	Vanadium	µg/L	631	664	582 - 743	Acceptable	EPA 200.7
0015	Zinc	µg/L	350	331	283 - 384	Acceptable	EPA 200.7

ACCREDITED Lab Code: 1539-01

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

WP-180 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 03/23/10
Study Dates: 01/18/10 - 03/04/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Trace Metals (cat# 586)							
0001	Aluminum	µg/L	1300	1410	1150 - 1660	Acceptable	EPA 200.8
0016	Antimony	µg/L	462	458	319 - 552	Acceptable	EPA 200.8
0002	Arsenic	µg/L	270	273	226 - 321	Acceptable	EPA 200.8
1015	Barium	µg/L	306	316	274 - 356	Acceptable	EPA 200.8
0003	Beryllium	µg/L	113	120	101 - 136	Acceptable	EPA 200.8
1025	Boron	µg/L		1600	1300 - 1860	Not Reported	
0004	Cadmium	µg/L	515	553	472 - 628	Acceptable	EPA 200.8
0006	Chromium	µg/L	783	813	709 - 919	Acceptable	EPA 200.8
0005	Cobalt	µg/L	736	744	654 - 834	Acceptable	EPA 200.8
0007	Copper	µg/L	733	764	688 - 840	Acceptable	EPA 200.8
0008	Iron	µg/L	1460	1400	1240 - 1580	Acceptable	EPA 200.8
0012	Lead	µg/L	346	367	317 - 415	Acceptable	EPA 200.8
0010	Manganese	µg/L	469	470	421 - 522	Acceptable	EPA 200.8
0074	Molybdenum	µg/L	88.9	88.5	69.8 - 106	Acceptable	EPA 200.8
0011	Nickel	µg/L	1580	1580	1420 - 1760	Acceptable	EPA 200.8
0013	Selenium	µg/L	1240	1300	1030 - 1500	Acceptable	EPA 200.8
0017	Silver	µg/L	217	209	179 - 240	Acceptable	EPA 200.8
0075	Strontium	µg/L	62.5	63.9	52.8 - 74.8	Acceptable	EPA 200.8
0018	Thallium	µg/L	503	529	426 - 635	Acceptable	EPA 200.8
0014	Vanadium	µg/L	677	664	582 - 743	Acceptable	EPA 200.8
0015	Zinc	µg/L	310	331	283 - 384	Acceptable	EPA 200.8

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

WP-180 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 03/23/10
Study Dates: 01/18/10 - 03/04/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Trace Metals (cat# 586)							
0001	Aluminum	µg/L	1370	1410	1150 - 1660	Acceptable	EPA 6010B
0016	Antimony	µg/L	451	458	319 - 552	Acceptable	EPA 6010B
0002	Arsenic	µg/L	264	273	226 - 321	Acceptable	EPA 6010B
1015	Barium	µg/L	311	316	274 - 356	Acceptable	EPA 6010B
0003	Beryllium	µg/L	117	120	101 - 136	Acceptable	EPA 6010B
1025	Boron	µg/L	1590	1600	1300 - 1860	Acceptable	EPA 6010B
0004	Cadmium	µg/L	551	553	472 - 628	Acceptable	EPA 6010B
0006	Chromium	µg/L	827	813	709 - 919	Acceptable	EPA 6010B
0005	Cobalt	µg/L	770	744	654 - 834	Acceptable	EPA 6010B
0007	Copper	µg/L	708	764	688 - 840	Acceptable	EPA 6010B
0008	Iron	µg/L	1430	1400	1240 - 1580	Acceptable	EPA 6010B
0012	Lead	µg/L	352	367	317 - 415	Acceptable	EPA 6010B
0010	Manganese	µg/L	482	470	421 - 522	Acceptable	EPA 6010B
0074	Molybdenum	µg/L	89.8	88.5	69.8 - 106	Acceptable	EPA 6010B
0011	Nickel	µg/L	1530	1580	1420 - 1760	Acceptable	EPA 6010B
0013	Selenium	µg/L	1230	1300	1030 - 1500	Acceptable	EPA 6010B
0017	Silver	µg/L	200	209	179 - 240	Acceptable	EPA 6010B
0075	Strontium	µg/L	62.6	63.9	52.8 - 74.8	Acceptable	EPA 6010B
0018	Thallium	µg/L	500	529	426 - 635	Acceptable	EPA 6010B
0014	Vanadium	µg/L	635	664	582 - 743	Acceptable	EPA 6010B
0015	Zinc	µg/L	342	331	283 - 384	Acceptable	EPA 6010B

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

WP-180 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 03/23/10
Study Dates: 01/18/10 - 03/04/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Trace Metals (cat# 586)							
0001	Aluminum	µg/L	1390	1410	1150 - 1660	Acceptable	EPA 6020
0016	Antimony	µg/L	452	458	319 - 552	Acceptable	EPA 6020
0002	Arsenic	µg/L	260	273	226 - 321	Acceptable	EPA 6020
1015	Barium	µg/L	312	316	274 - 356	Acceptable	EPA 6020
0003	Beryllium	µg/L	114	120	101 - 136	Acceptable	EPA 6020
1025	Boron	µg/L		1600	1300 - 1860	Not Reported	
0004	Cadmium	µg/L	529	553	472 - 628	Acceptable	EPA 6020
0006	Chromium	µg/L	822	813	709 - 919	Acceptable	EPA 6020
0005	Cobalt	µg/L	733	744	654 - 834	Acceptable	EPA 6020
0007	Copper	µg/L	749	764	688 - 840	Acceptable	EPA 6020
0008	Iron	µg/L	1390	1400	1240 - 1580	Acceptable	EPA 6020
0012	Lead	µg/L	348	367	317 - 415	Acceptable	EPA 6020
0010	Manganese	µg/L	464	470	421 - 522	Acceptable	EPA 6020
0074	Molybdenum	µg/L	88.0	88.5	69.8 - 106	Acceptable	EPA 6020
0011	Nickel	µg/L	1550	1580	1420 - 1760	Acceptable	EPA 6020
0013	Selenium	µg/L	1260	1300	1030 - 1500	Acceptable	EPA 6020
0017	Silver	µg/L	225	209	179 - 240	Acceptable	EPA 6020
0075	Strontium	µg/L	64.7	63.9	52.8 - 74.8	Acceptable	EPA 6020
0018	Thallium	µg/L	499	529	426 - 635	Acceptable	EPA 6020
0014	Vanadium	µg/L	636	664	582 - 743	Acceptable	EPA 6020
0015	Zinc	µg/L	300	331	283 - 384	Acceptable	EPA 6020
WP Mercury (cat# 574)							
0009	Mercury	µg/L	10.0	10.6	6.53 - 14.4	Acceptable	EPA 7470A
WP Mercury (cat# 574)							
0009	Mercury	µg/L	10.0	10.6	6.53 - 14.4	Acceptable	EPA 245.1
WP Hexavalent Chromium (cat# 898)							
1045	Hexavalent Chromium	µg/L	311	320	258 - 378	Acceptable	EPA 7196A
WP Hexavalent Chromium (cat# 898)							
1045	Hexavalent Chromium	µg/L	309	320	258 - 378	Acceptable	SM3500Cr D
WP Hexavalent Chromium (cat# 898)							
1045	Hexavalent Chromium	µg/L	304	320	258 - 378	Acceptable	EPA 7199
WP Tin & Titanium (cat# 573)							
1175	Tin	µg/L	2720	2460	1940 - 2990	Acceptable	EPA 200.7
0076	Titanium	µg/L	268	256	220 - 288	Acceptable	EPA 200.7
WP Tin & Titanium (cat# 573)							
1175	Tin	µg/L	2810	2460	1940 - 2990	Acceptable	EPA 200.8
0076	Titanium	µg/L	271	256	220 - 288	Acceptable	EPA 200.8

ACCREDITED Lab Code 1539-01

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

R2-0000989

WP-180 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 03/23/10
Study Dates: 01/18/10 - 03/04/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Tin & Titanium (cat# 573)							
1175	Tin	µg/L	2510	2460	1940 - 2990	Acceptable	EPA 6010B
0076	Titanium	µg/L	251	256	220 - 288	Acceptable	EPA 6010B
WP Tin & Titanium (cat# 573)							
1175	Tin	µg/L	2390	2460	1940 - 2990	Acceptable	EPA 6020
0076	Titanium	µg/L	261	256	220 - 288	Acceptable	EPA 6020
WP Color (cat# 882)							
1605	Color	PC units	30	25.0	15.0 - 35.0	Acceptable	SM2120B
WP Turbidity (cat# 893)							
2055	Turbidity	NTU	6.8	7.07	5.91 - 8.09	Acceptable	EPA 180.1
WP Total Cyanide (cat# 588)							
0071	Cyanide, total	mg/L	0.95	0.920	0.594 - 1.24	Acceptable	EPA 335.4
WP Total Phenolics (4-AAP) (cat# 589)							
0097	Phenolics, total	mg/L	0.185	0.213	0.110 - 0.316	Acceptable	EPA 420.4
WP Silica (cat# 890)							
1990	Silica as SiO2	mg/L	190	191	143 - 239	Acceptable	EPA 200.7
WP Silica (cat# 890)							
1990	Silica as SiO2	mg/L	185	191	143 - 239	Acceptable	EPA 6010B
WP Silica (cat# 890)							
1990	Silica as SiO2	mg/L	169	191	143 - 239	Acceptable	SM4500Si D
WP Sulfide (cat# 891)							
2005	Sulfide	mg/L	6.19	7.00	3.26 - 10.0	Acceptable	SM4500S2- F
WP Surfactants - MBAS (cat# 892)							
2025	Surfactants (MBAS)	mg/L	0.582	0.524	0.317 - 0.762	Acceptable	SM5540C
WP Acidity (cat# 885)							
1500	Acidity as CaCO3	mg/L	889	926	818 - 1020	Acceptable	SM2310B
WP Bromide (cat# 887)							
1540	Bromide	mg/L	4.56	4.68	3.98 - 5.38	Acceptable	EPA 300.0
WP Bromide (cat# 887)							
1540	Bromide	mg/L	4.56	4.68	3.98 - 5.38	Acceptable	EPA 9056
WP Total Residual Chlorine (cat# 587)							
0098	Total Residual Chlorine	mg/L	1.72	1.60	1.15 - 1.98	Acceptable	SM4500Cl F

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

Study: **WP-180**

ERA Customer Number: **A064801**

Laboratory Name: **Accutest Mid Atlantic**

Microbiology Results

WP-180 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 03/23/10
Study Dates: 01/18/10 - 03/04/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP WasteWatR™ Coliform MicrobE™ (cat# 576)							
2500	Total Coliforms (MF)	CFU/100mL	695	1070	414 - 2750	Acceptable	SM9222B
2530	Fecal Coliforms (MF)	CFU/100mL	240	604	129 - 2820	Acceptable	SM9222D m FC
2525	E.coli (MF)	CFU/100mL		932	399 - 2180	Not Reported	
2500	Total Coliforms (MPN)	MPN/100mL		1300	421 - 4040	Not Reported	
2530	Fecal Coliforms (MPN)	MPN/100mL		1010	160 - 6370	Not Reported	
2525	E.coli (MPN)	MPN/100mL		1370	601 - 3110	Not Reported	

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

Study: **WP-180**

ERA Customer Number: **A064801**

Laboratory Name: **Accutest Mid Atlantic**

Organic Results

WP-180 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 03/23/10
Study Dates: 01/18/10 - 03/04/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Volatiles (cat# 830)							
4315	Acetone	µg/L		0.00		Not Reported	
4320	Acetonitrile	µg/L		0.00		Not Reported	
4325	Acrolein	µg/L		0.00		Not Reported	
4340	Acrylonitrile	µg/L		0.00		Not Reported	
0065	Benzene	µg/L	39.3	40.1	28.6 - 51.4	Acceptable	EPA 602
0060	Bromodichloromethane	µg/L		41.1	28.9 - 55.4	Not Reported	
0062	Bromoform	µg/L		38.3	24.0 - 52.5	Not Reported	
4950	Bromomethane	µg/L		28.8	11.5 - 46.1	Not Reported	
4410	2-Butanone (MEK)	µg/L		48.9	14.2 - 76.4	Not Reported	
5000	tert-Butyl methyl ether (MTBE)	µg/L	23.0	23.9	14.1 - 35.0	Acceptable	EPA 602
4450	Carbon disulfide	µg/L		0.00		Not Reported	
0058	Carbon tetrachloride	µg/L		67.5	36.9 - 92.0	Not Reported	
0064	Chlorobenzene	µg/L	35.3	37.2	26.8 - 46.9	Acceptable	EPA 602
0061	Chlorodibromomethane	µg/L		80.0	54.8 - 106	Not Reported	
4485	Chloroethane	µg/L		0.00		Not Reported	
4500	2-Chloroethylvinylether	µg/L		0.00		Not Reported	
0055	Chloroform	µg/L		20.7	14.2 - 27.7	Not Reported	
4960	Chloromethane	µg/L		0.00		Not Reported	
4570	1,2-Dibromo-3-chloropropane (DBCP)	µg/L		0.00		Not Reported	
4585	1,2-Dibromoethane (EDB)	µg/L		0.00		Not Reported	
4595	Dibromomethane	µg/L		0.00		Not Reported	
0094	1,2-Dichlorobenzene	µg/L	68.8	69.0	47.9 - 89.5	Acceptable	EPA 602
0096	1,3-Dichlorobenzene	µg/L	26.1	27.5	18.0 - 35.5	Acceptable	EPA 602
0095	1,4-Dichlorobenzene	µg/L	10.1	9.60	5.97 - 13.5	Acceptable	EPA 602
4625	Dichlorodifluoromethane (Freon 12)	µg/L		0.00		Not Reported	
4630	1,1-Dichloroethane	µg/L		32.6	22.0 - 44.5	Not Reported	
0054	1,2-Dichloroethane	µg/L		24.2	16.7 - 32.7	Not Reported	
4640	1,1-Dichloroethylene	µg/L		0.00		Not Reported	
4645	cis-1,2-Dichloroethylene	µg/L		0.00		Not Reported	
4700	trans-1,2-Dichloroethylene	µg/L		0.00		Not Reported	
4655	1,2-Dichloropropane	µg/L		24.6	15.7 - 33.1	Not Reported	
4680	cis-1,3-Dichloropropylene	µg/L		39.4	27.6 - 51.2	Not Reported	

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

WP-180 Final Complete Report

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Report Issued: 03/23/10
Study Dates: 01/18/10 - 03/04/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Volatiles (cat# 830) (Continued)							
4685	trans-1,3-Dichloropropylene	µg/L		62.9	40.5 - 85.1	Not Reported	
0066	Ethylbenzene	µg/L	94.4	95.3	65.9 - 120	Acceptable	EPA 602
4835	Hexachlorobutadiene	µg/L		0.00		Not Reported	
4860	2-Hexanone	µg/L		0.00		Not Reported	
0063	Methylene chloride	µg/L		24.9	15.0 - 35.8	Not Reported	
4995	4-Methyl-2-pentanone (MIBK)	µg/L		32.8	11.3 - 52.1	Not Reported	
5005	Naphthalene	µg/L		0.00		Not Reported	
5100	Styrene	µg/L		50.4	32.5 - 68.7	Not Reported	
5105	1,1,1,2-Tetrachloroethane	µg/L		43.9	28.4 - 59.1	Not Reported	
5110	1,1,2,2-Tetrachloroethane	µg/L		52.5	29.9 - 77.9	Not Reported	
0059	Tetrachloroethylene	µg/L		36.7	19.9 - 48.2	Not Reported	
0067	Toluene	µg/L	42.2	44.8	31.1 - 56.4	Acceptable	EPA 602
5155	1,2,4-Trichlorobenzene	µg/L		0.00		Not Reported	
0056	1,1,1-Trichloroethane	µg/L		31.9	20.0 - 42.5	Not Reported	
5165	1,1,2-Trichloroethane	µg/L		0.00		Not Reported	
0057	Trichloroethylene	µg/L		23.5	14.8 - 31.5	Not Reported	
5175	Trichlorofluoromethane	µg/L		33.3	13.3 - 53.3	Not Reported	
5180	1,2,3-Trichloropropane (TCP)	µg/L		0.00		Not Reported	
5225	Vinyl acetate	µg/L		0.00		Not Reported	
5235	Vinyl chloride	µg/L		0.00		Not Reported	
5260	Xylenes, total	µg/L	148	158	90.6 - 212	Acceptable	EPA 602

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Volatiles (cat# 830)							
4315	Acetone	µg/L		0.00		Not Reported	
4320	Acetonitrile	µg/L		0.00		Not Reported	
4325	Acrolein	µg/L		0.00		Not Reported	
4340	Acrylonitrile	µg/L		0.00		Not Reported	
0065	Benzene	µg/L	39.3	40.1	28.6 - 51.4	Acceptable	EPA 8021B
0060	Bromodichloromethane	µg/L		41.1	28.9 - 55.4	Not Reported	
0062	Bromoform	µg/L		38.3	24.0 - 52.5	Not Reported	
4950	Bromomethane	µg/L		28.8	11.5 - 46.1	Not Reported	
4410	2-Butanone (MEK)	µg/L		48.9	14.2 - 76.4	Not Reported	
5000	tert-Butyl methyl ether (MTBE)	µg/L	23.0	23.9	14.1 - 35.0	Acceptable	EPA 8021B
4450	Carbon disulfide	µg/L		0.00		Not Reported	
0058	Carbon tetrachloride	µg/L		67.5	36.9 - 92.0	Not Reported	
0064	Chlorobenzene	µg/L	35.3	37.2	26.8 - 46.9	Acceptable	EPA 8021B
0061	Chlorodibromomethane	µg/L		80.0	54.8 - 106	Not Reported	
4485	Chloroethane	µg/L		0.00		Not Reported	
4500	2-Chloroethylvinylether	µg/L		0.00		Not Reported	
0055	Chloroform	µg/L		20.7	14.2 - 27.7	Not Reported	
4960	Chloromethane	µg/L		0.00		Not Reported	
4570	1,2-Dibromo-3-chloropropane (DBCP)	µg/L		0.00		Not Reported	
4585	1,2-Dibromoethane (EDB)	µg/L		0.00		Not Reported	
4595	Dibromomethane	µg/L		0.00		Not Reported	
0094	1,2-Dichlorobenzene	µg/L	68.8	69.0	47.9 - 89.5	Acceptable	EPA 8021B
0096	1,3-Dichlorobenzene	µg/L	26.1	27.5	18.0 - 35.5	Acceptable	EPA 8021B
0095	1,4-Dichlorobenzene	µg/L	10.1	9.60	5.97 - 13.5	Acceptable	EPA 8021B
4625	Dichlorodifluoromethane (Freon 12)	µg/L		0.00		Not Reported	
4630	1,1-Dichloroethane	µg/L		32.6	22.0 - 44.5	Not Reported	
0054	1,2-Dichloroethane	µg/L		24.2	16.7 - 32.7	Not Reported	
4640	1,1-Dichloroethylene	µg/L		0.00		Not Reported	
4645	cis-1,2-Dichloroethylene	µg/L		0.00		Not Reported	
4700	trans-1,2-Dichloroethylene	µg/L		0.00		Not Reported	
4655	1,2-Dichloropropane	µg/L		24.6	15.7 - 33.1	Not Reported	
4680	cis-1,3-Dichloropropylene	µg/L		39.4	27.6 - 51.2	Not Reported	

ACCREDITED Lab Code: 1539-01

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

WP-180 Final Complete Report

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Report Issued: 03/23/10
Study Dates: 01/18/10 - 03/04/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Volatiles (cat# 830) (Continued)							
4685	trans-1,3-Dichloropropylene	µg/L		62.9	40.5 - 85.1	Not Reported	
0066	Ethylbenzene	µg/L	94.4	95.3	65.9 - 120	Acceptable	EPA 8021B
4835	Hexachlorobutadiene	µg/L		0.00		Not Reported	
4860	2-Hexanone	µg/L		0.00		Not Reported	
0063	Methylene chloride	µg/L		24.9	15.0 - 35.8	Not Reported	
4995	4-Methyl-2-pentanone (MIBK)	µg/L		32.8	11.3 - 52.1	Not Reported	
5005	Naphthalene	µg/L		0.00		Not Reported	
5100	Styrene	µg/L		50.4	32.5 - 68.7	Not Reported	
5105	1,1,1,2-Tetrachloroethane	µg/L		43.9	28.4 - 59.1	Not Reported	
5110	1,1,2,2-Tetrachloroethane	µg/L		52.5	29.9 - 77.9	Not Reported	
0059	Tetrachloroethylene	µg/L		36.7	19.9 - 48.2	Not Reported	
0067	Toluene	µg/L	42.2	44.8	31.1 - 56.4	Acceptable	EPA 8021B
5155	1,2,4-Trichlorobenzene	µg/L		0.00		Not Reported	
0056	1,1,1-Trichloroethane	µg/L		31.9	20.0 - 42.5	Not Reported	
5165	1,1,2-Trichloroethane	µg/L		0.00		Not Reported	
0057	Trichloroethylene	µg/L		23.5	14.8 - 31.5	Not Reported	
5175	Trichlorofluoromethane	µg/L		33.3	13.3 - 53.3	Not Reported	
5180	1,2,3-Trichloropropane (TCP)	µg/L		0.00		Not Reported	
5225	Vinyl acetate	µg/L		0.00		Not Reported	
5235	Vinyl chloride	µg/L		0.00		Not Reported	
5260	Xylenes, total	µg/L	148	158	90.6 - 212	Acceptable	EPA 8021B

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

WP-180 Final Complete Report

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Report Issued: 03/23/10
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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Volatiles (cat# 830)							
4315	Acetone	µg/L	< 5.0	0.00		Acceptable	EPA 624
4320	Acetonitrile	µg/L	< 2.0	0.00		Acceptable	EPA 624
4325	Acrolein	µg/L	< 50	0.00		Acceptable	EPA 624
4340	Acrylonitrile	µg/L	< 10	0.00		Acceptable	EPA 624
0065	Benzene	µg/L	37.7	40.1	28.6 - 51.4	Acceptable	EPA 624
0060	Bromodichloromethane	µg/L	41.2	41.1	28.9 - 55.4	Acceptable	EPA 624
0062	Bromoform	µg/L	40.3	38.3	24.0 - 52.5	Acceptable	EPA 624
4950	Bromomethane	µg/L	29.7	28.8	11.5 - 46.1	Acceptable	EPA 624
4410	2-Butanone (MEK)	µg/L	38.4	48.9	14.2 - 76.4	Acceptable	EPA 624
5000	tert-Butyl methyl ether (MTBE)	µg/L	22.9	23.9	14.1 - 35.0	Acceptable	EPA 624
4450	Carbon disulfide	µg/L	< 1.0	0.00		Acceptable	EPA 624
0058	Carbon tetrachloride	µg/L	70.4	67.5	36.9 - 92.0	Acceptable	EPA 624
0064	Chlorobenzene	µg/L	34.8	37.2	26.8 - 46.9	Acceptable	EPA 624
0061	Chlorodibromomethane	µg/L	79.7	80.0	54.8 - 106	Acceptable	EPA 624
4485	Chloroethane	µg/L	< 1.0	0.00		Acceptable	EPA 624
4500	2-Chloroethylvinylether	µg/L	< 5.0	0.00		Acceptable	EPA 624
0055	Chloroform	µg/L	20.6	20.7	14.2 - 27.7	Acceptable	EPA 624
4960	Chloromethane	µg/L	< 1.0	0.00		Acceptable	EPA 624
4570	1,2-Dibromo-3-chloropropane (DBCP)	µg/L	< 2.0	0.00		Acceptable	EPA 624
4585	1,2-Dibromoethane (EDB)	µg/L	< 1.0	0.00		Acceptable	EPA 624
4595	Dibromomethane	µg/L	< 1.0	0.00		Acceptable	EPA 624
0094	1,2-Dichlorobenzene	µg/L	65.1	69.0	47.9 - 89.5	Acceptable	EPA 624
0096	1,3-Dichlorobenzene	µg/L	24.8	27.5	18.0 - 35.5	Acceptable	EPA 624
0095	1,4-Dichlorobenzene	µg/L	9.0	9.60	5.97 - 13.5	Acceptable	EPA 624
4625	Dichlorodifluoromethane (Freon 12)	µg/L	< 2.0	0.00		Acceptable	EPA 624
4630	1,1-Dichloroethane	µg/L	33.0	32.6	22.0 - 44.5	Acceptable	EPA 624
0054	1,2-Dichloroethane	µg/L	24.1	24.2	16.7 - 32.7	Acceptable	EPA 624
4640	1,1-Dichloroethylene	µg/L	< 1.0	0.00		Acceptable	EPA 624
4645	cis-1,2-Dichloroethylene	µg/L	< 1.0	0.00		Acceptable	EPA 624
4700	trans-1,2-Dichloroethylene	µg/L	< 1.0	0.00		Acceptable	EPA 624
4655	1,2-Dichloropropane	µg/L	22.5	24.6	15.7 - 33.1	Acceptable	EPA 624
4680	cis-1,3-Dichloropropylene	µg/L	38.6	39.4	27.6 - 51.2	Acceptable	EPA 624

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

WP-180 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 03/23/10
Study Dates: 01/18/10 - 03/04/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Volatiles (cat# 830) (Continued)							
4685	trans-1,3-Dichloropropylene	µg/L	61.8	62.9	40.5 - 85.1	Acceptable	EPA 624
0066	Ethylbenzene	µg/L	92.0	95.3	65.9 - 120	Acceptable	EPA 624
4835	Hexachlorobutadiene	µg/L	< 5.0	0.00		Acceptable	EPA 624
4860	2-Hexanone	µg/L	< 5.0	0.00		Acceptable	EPA 624
0063	Methylene chloride	µg/L	23.2	24.9	15.0 - 35.8	Acceptable	EPA 624
4995	4-Methyl-2-pentanone (MIBK)	µg/L	32.2	32.8	11.3 - 52.1	Acceptable	EPA 624
5005	Naphthalene	µg/L	< 2.0	0.00		Acceptable	EPA 624
5100	Styrene	µg/L	50.4	50.4	32.5 - 68.7	Acceptable	EPA 624
5105	1,1,1,2-Tetrachloroethane	µg/L	44.1	43.9	28.4 - 59.1	Acceptable	EPA 624
5110	1,1,2,2-Tetrachloroethane	µg/L	49.8	52.5	29.9 - 77.9	Acceptable	EPA 624
0059	Tetrachloroethylene	µg/L	33.0	36.7	19.9 - 48.2	Acceptable	EPA 624
0067	Toluene	µg/L	41.7	44.8	31.1 - 56.4	Acceptable	EPA 624
5155	1,2,4-Trichlorobenzene	µg/L	< 2.0	0.00		Acceptable	EPA 624
0056	1,1,1-Trichloroethane	µg/L	31.7	31.9	20.0 - 42.5	Acceptable	EPA 624
5165	1,1,2-Trichloroethane	µg/L	< 1.0	0.00		Acceptable	EPA 624
0057	Trichloroethylene	µg/L	21.8	23.5	14.8 - 31.5	Acceptable	EPA 624
5175	Trichlorofluoromethane	µg/L	38.2	33.3	13.3 - 53.3	Acceptable	EPA 624
5180	1,2,3-Trichloropropane (TCP)	µg/L	< 1.0	0.00		Acceptable	EPA 624
5225	Vinyl acetate	µg/L	< 5.0	0.00		Acceptable	EPA 624
5235	Vinyl chloride	µg/L	< 1.0	0.00		Acceptable	EPA 624
5260	Xylenes, total	µg/L	156	158	90.6 - 212	Acceptable	EPA 624

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

WP-180 Final Complete Report

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2235 Route 130
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732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 03/23/10
Study Dates: 01/18/10 - 03/04/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Volatiles (cat# 830)							
4315	Acetone	µg/L	< 5.0	0.00		Acceptable	EPA 8260B
4320	Acetonitrile	µg/L	< 2.0	0.00		Acceptable	EPA 8260B
4325	Acrolein	µg/L	< 50	0.00		Acceptable	EPA 8260B
4340	Acrylonitrile	µg/L	< 10	0.00		Acceptable	EPA 8260B
0065	Benzene	µg/L	37.7	40.1	28.6 - 51.4	Acceptable	EPA 8260B
0060	Bromodichloromethane	µg/L	41.2	41.1	28.9 - 55.4	Acceptable	EPA 8260B
0062	Bromoform	µg/L	40.3	38.3	24.0 - 52.5	Acceptable	EPA 8260B
4950	Bromomethane	µg/L	29.7	28.8	11.5 - 46.1	Acceptable	EPA 8260B
4410	2-Butanone (MEK)	µg/L	38.4	48.9	14.2 - 76.4	Acceptable	EPA 8260B
5000	tert-Butyl methyl ether (MTBE)	µg/L	22.9	23.9	14.1 - 35.0	Acceptable	EPA 8260B
4450	Carbon disulfide	µg/L	< 1.0	0.00		Acceptable	EPA 8260B
0058	Carbon tetrachloride	µg/L	70.4	67.5	36.9 - 92.0	Acceptable	EPA 8260B
0064	Chlorobenzene	µg/L	34.8	37.2	26.8 - 46.9	Acceptable	EPA 8260B
0061	Chlorodibromomethane	µg/L	79.7	80.0	54.8 - 106	Acceptable	EPA 8260B
4485	Chloroethane	µg/L	< 1.0	0.00		Acceptable	EPA 8260B
4500	2-Chloroethylvinylether	µg/L	< 5.0	0.00		Acceptable	EPA 8260B
0055	Chloroform	µg/L	20.6	20.7	14.2 - 27.7	Acceptable	EPA 8260B
4960	Chloromethane	µg/L	< 1.0	0.00		Acceptable	EPA 8260B
4570	1,2-Dibromo-3-chloropropane (DBCP)	µg/L	< 2.0	0.00		Acceptable	EPA 8260B
4585	1,2-Dibromoethane (EDB)	µg/L	< 1.0	0.00		Acceptable	EPA 8260B
4595	Dibromomethane	µg/L	< 1.0	0.00		Acceptable	EPA 8260B
0094	1,2-Dichlorobenzene	µg/L	65.1	69.0	47.9 - 89.5	Acceptable	EPA 8260B
0096	1,3-Dichlorobenzene	µg/L	24.8	27.5	18.0 - 35.5	Acceptable	EPA 8260B
0095	1,4-Dichlorobenzene	µg/L	9.0	9.60	5.97 - 13.5	Acceptable	EPA 8260B
4625	Dichlorodifluoromethane (Freon 12)	µg/L	< 2.0	0.00		Acceptable	EPA 8260B
4630	1,1-Dichloroethane	µg/L	33.0	32.6	22.0 - 44.5	Acceptable	EPA 8260B
0054	1,2-Dichloroethane	µg/L	24.1	24.2	16.7 - 32.7	Acceptable	EPA 8260B
4640	1,1-Dichloroethylene	µg/L	< 1.0	0.00		Acceptable	EPA 8260B
4645	cis-1,2-Dichloroethylene	µg/L	< 1.0	0.00		Acceptable	EPA 8260B
4700	trans-1,2-Dichloroethylene	µg/L	< 1.0	0.00		Acceptable	EPA 8260B
4655	1,2-Dichloropropane	µg/L	22.5	24.6	15.7 - 33.1	Acceptable	EPA 8260B
4680	cis-1,3-Dichloropropylene	µg/L	38.6	39.4	27.6 - 51.2	Acceptable	EPA 8260B

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

WP-180 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 03/23/10
Study Dates: 01/18/10 - 03/04/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Volatiles (cat# 830) (Continued)							
4685	trans-1,3-Dichloropropylene	µg/L	61.8	62.9	40.5 - 85.1	Acceptable	EPA 8260B
0066	Ethylbenzene	µg/L	92.0	95.3	65.9 - 120	Acceptable	EPA 8260B
4835	Hexachlorobutadiene	µg/L	< 5.0	0.00		Acceptable	EPA 8260B
4860	2-Hexanone	µg/L	< 5.0	0.00		Acceptable	EPA 8260B
0063	Methylene chloride	µg/L	23.2	24.9	15.0 - 35.8	Acceptable	EPA 8260B
4995	4-Methyl-2-pentanone (MIBK)	µg/L	32.2	32.8	11.3 - 52.1	Acceptable	EPA 8260B
5005	Naphthalene	µg/L	< 2.0	0.00		Acceptable	EPA 8260B
5100	Styrene	µg/L	50.4	50.4	32.5 - 68.7	Acceptable	EPA 8260B
5105	1,1,1,2-Tetrachloroethane	µg/L	44.1	43.9	28.4 - 59.1	Acceptable	EPA 8260B
5110	1,1,2,2-Tetrachloroethane	µg/L	49.8	52.5	29.9 - 77.9	Acceptable	EPA 8260B
0059	Tetrachloroethylene	µg/L	33.0	36.7	19.9 - 48.2	Acceptable	EPA 8260B
0067	Toluene	µg/L	41.7	44.8	31.1 - 56.4	Acceptable	EPA 8260B
5155	1,2,4-Trichlorobenzene	µg/L	< 2.0	0.00		Acceptable	EPA 8260B
0056	1,1,1-Trichloroethane	µg/L	31.7	31.9	20.0 - 42.5	Acceptable	EPA 8260B
5165	1,1,2-Trichloroethane	µg/L	< 1.0	0.00		Acceptable	EPA 8260B
0057	Trichloroethylene	µg/L	21.8	23.5	14.8 - 31.5	Acceptable	EPA 8260B
5175	Trichlorofluoromethane	µg/L	38.2	33.3	13.3 - 53.3	Acceptable	EPA 8260B
5180	1,2,3-Trichloropropane (TCP)	µg/L	< 1.0	0.00		Acceptable	EPA 8260B
5225	Vinyl acetate	µg/L	< 5.0	0.00		Acceptable	EPA 8260B
5235	Vinyl chloride	µg/L	< 1.0	0.00		Acceptable	EPA 8260B
5260	Xylenes, total	µg/L	156	158	90.6 - 212	Acceptable	EPA 8260B
WP Chlorinated Acid Herbicides (cat# 829)							
8505	Acifluorfen	µg/L		3.89	0.690 - 5.79	Not Reported	
8530	Bentazon	µg/L		2.56	0.256 - 4.86	Not Reported	
8540	Chloramben	µg/L		4.79	0.479 - 7.02	Not Reported	
8545	2,4-D	µg/L	3.1	6.28	0.628 - 10.2	Acceptable	EPA 8151A
8560	2,4-DB	µg/L	7.5	9.00	0.900 - 17.2	Acceptable	EPA 8151A
8550	Dacthal diacid (DCPA)	µg/L		7.65	0.765 - 13.8	Not Reported	
8555	Dalapon	µg/L	2.4	3.47	0.347 - 5.79	Acceptable	EPA 8151A
8595	Dicamba	µg/L	5.0	4.99	0.499 - 7.34	Acceptable	EPA 8151A
8600	3,5-Dichlorobenzoic acid	µg/L		5.19	1.37 - 7.70	Not Reported	
8605	Dichlorprop	µg/L	3.5	5.32	0.851 - 7.94	Acceptable	EPA 8151A
8620	Dinoseb	µg/L	3.4	5.54	0.554 - 8.61	Acceptable	EPA 8151A
7775	MCPA	µg/L	< 25	0.00		Acceptable	EPA 8151A
7780	MCPP	µg/L	< 25	0.00		Acceptable	EPA 8151A
6500	4-Nitrophenol	µg/L		3.07	0.307 - 5.16	Not Reported	
6605	Pentachlorophenol	µg/L	3.2	3.27	0.327 - 5.23	Acceptable	EPA 8151A
8645	Picloram	µg/L	5.4	7.39	0.739 - 13.2	Acceptable	EPA 8151A
8655	2,4,5-T	µg/L	2.6	2.86	0.286 - 4.48	Acceptable	EPA 8151A
8650	2,4,5-TP (Silvex)	µg/L	4.5	5.56	0.757 - 8.15	Acceptable	EPA 8151A

WP-180 Final Complete Report

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Chlorinated Acid Herbicides (cat# 829)							
8505	Acifluorfen	µg/L		3.89	0.690 - 5.79	Not Reported	
8530	Bentazon	µg/L		2.56	0.256 - 4.86	Not Reported	
8540	Chloramben	µg/L		4.79	0.479 - 7.02	Not Reported	
8545	2,4-D	µg/L	3.1	6.28	0.628 - 10.2	Acceptable	EPA 515.1
8560	2,4-DB	µg/L	7.5	9.00	0.900 - 17.2	Acceptable	EPA 515.1
8550	Dacthal diacid (DCPA)	µg/L		7.65	0.765 - 13.8	Not Reported	
8555	Dalapon	µg/L	2.4	3.47	0.347 - 5.79	Acceptable	EPA 515.1
8595	Dicamba	µg/L	5.0	4.99	0.499 - 7.34	Acceptable	EPA 515.1
8600	3,5-Dichlorobenzoic acid	µg/L		5.19	1.37 - 7.70	Not Reported	
8605	Dichlorprop	µg/L	3.5	5.32	0.851 - 7.94	Acceptable	EPA 515.1
8620	Dinoseb	µg/L	3.4	5.54	0.554 - 8.61	Acceptable	EPA 515.1
7775	MCPA	µg/L	< 25	0.00		Acceptable	EPA 515.1
7780	MCPP	µg/L	< 25	0.00		Acceptable	EPA 515.1
6500	4-Nitrophenol	µg/L		3.07	0.307 - 5.16	Not Reported	
6605	Pentachlorophenol	µg/L	3.2	3.27	0.327 - 5.23	Acceptable	EPA 515.1
8645	Picloram	µg/L	5.4	7.39	0.739 - 13.2	Acceptable	EPA 515.1
8655	2,4,5-T	µg/L	2.6	2.86	0.286 - 4.48	Acceptable	EPA 515.1
8650	2,4,5-TP (Silvex)	µg/L	4.5	5.56	0.757 - 8.15	Acceptable	EPA 515.1
WP PCBs in Water (cat# 832S)							
0040	Aroclor 1016	µg/L	< 0.50	0.00		Acceptable	EPA 608
8885	Aroclor 1221	µg/L	< 0.50	0.00		Acceptable	EPA 608
0042	Aroclor 1232	µg/L	< 0.50	0.00		Acceptable	EPA 608
0040	Aroclor 1242	µg/L	< 0.50	0.00		Acceptable	EPA 608
0044	Aroclor 1248	µg/L	< 0.50	0.00		Acceptable	EPA 608
0045	Aroclor 1254	µg/L	< 0.50	0.00		Acceptable	EPA 608
0046	Aroclor 1260	µg/L	2.7	2.62	1.25 - 3.47	Acceptable	EPA 608
WP PCBs in Water (cat# 832S)							
0040	Aroclor 1016	µg/L	< 0.5	0.00		Acceptable	EPA 8082
8885	Aroclor 1221	µg/L	< 0.5	0.00		Acceptable	EPA 8082
0042	Aroclor 1232	µg/L	< 0.5	0.00		Acceptable	EPA 8082
0040	Aroclor 1242	µg/L	< 0.5	0.00		Acceptable	EPA 8082
0044	Aroclor 1248	µg/L	< 0.5	0.00		Acceptable	EPA 8082
0045	Aroclor 1254	µg/L	< 0.5	0.00		Acceptable	EPA 8082
0046	Aroclor 1260	µg/L	2.7	2.62	1.25 - 3.47	Acceptable	EPA 8082
WP PCBs in Oil (cat# 835S)							
8880	Aroclor 1016	mg/kg	< 0.5	0.00		Acceptable	EPA 8082
8895	Aroclor 1242	mg/kg	20.2	32.0	5.30 - 44.2	Acceptable	EPA 8082
8905	Aroclor 1254	mg/kg	< 0.5	0.00		Acceptable	EPA 8082
8910	Aroclor 1260	mg/kg	< 0.5	0.00		Acceptable	EPA 8082

ACCREDITED Lab Code: 1539-01

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

WP-180 Final Complete Report

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2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 03/23/10
Study Dates: 01/18/10 - 03/04/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Base/Neutrals (cat# 833)							
5500	Acenaphthene	µg/L	14.4	18.2	8.77 - 23.9	Acceptable	EPA 625
5505	Acenaphthylene	µg/L	14.8	19.8	6.97 - 26.0	Acceptable	EPA 625
5145	2-Amino-1-methylbenzene (o-toluidine)	µg/L	< 5.0	0.00		Acceptable	EPA 625
5545	Aniline	µg/L	< 2.0	0.00		Acceptable	EPA 625
5555	Anthracene	µg/L	40.6	58.5	25.0 - 74.0	Acceptable	EPA 625
5595	Benzidine	µg/L	< 20.0	0.00		Acceptable	EPA 625
5575	Benzo(a)anthracene	µg/L	< 1.0	0.00		Acceptable	EPA 625
5585	Benzo(b)fluoranthene	µg/L	15.6	21.8	6.58 - 31.2	Acceptable	EPA 625
5600	Benzo(k)fluoranthene	µg/L	20.2	25.6	5.37 - 40.7	Acceptable	EPA 625
5590	Benzo(g,h,i)perylene	µg/L	17.9	25.4	5.35 - 38.1	Acceptable	EPA 625
5580	Benzo(a)pyrene	µg/L	29.1	38.4	11.8 - 50.6	Acceptable	EPA 625
5630	Benzyl alcohol	µg/L	< 2.0	0.00		Acceptable	EPA 625
5660	4-Bromophenyl-phenylether	µg/L	117	133	42.8 - 177	Acceptable	EPA 625
5670	Butylbenzylphthalate	µg/L	< 2.0	0.00		Acceptable	EPA 625
5680	Carbazole	µg/L	< 2.0	0.00		Acceptable	EPA 625
5745	4-Chloroaniline	µg/L	< 2.0	0.00		Acceptable	EPA 625
5760	bis(2-Chloroethoxy)methane	µg/L	126	141	55.8 - 167	Acceptable	EPA 625
5765	bis(2-Chloroethyl)ether	µg/L	46.9	48.1	14.3 - 61.6	Acceptable	EPA 625
5780	bis(2-Chloroisopropyl)ether	µg/L	< 2.0	0.00		Acceptable	EPA 625
5790	1-Chloronaphthalene	µg/L	< 2.0	0.00		Acceptable	EPA 625
5795	2-Chloronaphthalene	µg/L	< 2.0	0.00		Acceptable	EPA 625
5825	4-Chlorophenyl-phenylether	µg/L	126	124	46.4 - 154	Acceptable	EPA 625
5855	Chrysene	µg/L	10.5	15.0	7.11 - 23.0	Acceptable	EPA 625
5895	Dibenz(a,h)anthracene	µg/L	< 1.0	0.00		Acceptable	EPA 625
5905	Dibenzofuran	µg/L	< 2.0	0.00		Acceptable	EPA 625
5925	Di-n-butylphthalate	µg/L	< 2.0	0.00		Acceptable	EPA 625
4610	1,2-Dichlorobenzene	µg/L	129	141	18.1 - 166	Acceptable	EPA 625
4615	1,3-Dichlorobenzene	µg/L	118	129	15.6 - 149	Acceptable	EPA 625
4620	1,4-Dichlorobenzene	µg/L	28.4	32.8	3.28 - 43.6	Acceptable	EPA 625
5945	3,3'-Dichlorobenzidine	µg/L	< 2.0	0.00		Acceptable	EPA 625
6070	Diethylphthalate	µg/L	< 2.0	0.00		Acceptable	EPA 625
6135	Dimethylphthalate	µg/L	128	132	13.2 - 190	Acceptable	EPA 625

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Base/Neutrals (cat# 833) (Continued)							
6185	2,4-Dinitrotoluene	µg/L	84.9	93.2	34.3 - 116	Acceptable	EPA 625
6190	2,6-Dinitrotoluene	µg/L	141	134	56.0 - 168	Acceptable	EPA 625
6200	Di-n-octylphthalate	µg/L	< 2.0	0.00		Acceptable	EPA 625
6065	bis(2-Ethylhexyl)phthalate	µg/L	50.5	70.0	21.0 - 98.4	Acceptable	EPA 625
6265	Fluoranthene	µg/L	67.5	91.5	40.7 - 111	Acceptable	EPA 625
6270	Fluorene	µg/L	< 1.0	0.00		Acceptable	EPA 625
6275	Hexachlorobenzene	µg/L	68.2	98.6	42.9 - 121	Acceptable	EPA 625
4835	Hexachlorobutadiene	µg/L	94.3	95.4	10.6 - 115	Acceptable	EPA 625
6285	Hexachlorocyclopentadiene	µg/L	103	154	15.4 - 199	Acceptable	EPA 625
4840	Hexachloroethane	µg/L	78.8	88.9	9.22 - 105	Acceptable	EPA 625
6315	Indeno(1,2,3-cd)pyrene	µg/L	19.1	35.4	6.20 - 50.2	Acceptable	EPA 625
6320	Isophorone	µg/L	50.2	56.4	22.7 - 73.6	Acceptable	EPA 625
6385	2-Methylnaphthalene	µg/L	< 2.0	0.00		Acceptable	EPA 625
5005	Naphthalene	µg/L	93.4	116	30.5 - 138	Acceptable	EPA 625
6460	2-Nitroaniline	µg/L	< 5.0	0.00		Acceptable	EPA 625
6465	3-Nitroaniline	µg/L	< 5.0	0.00		Acceptable	EPA 625
6470	4-Nitroaniline	µg/L	< 5.0	0.00		Acceptable	EPA 625
5015	Nitrobenzene	µg/L	< 2.0	0.00		Acceptable	EPA 625
6525	N-Nitrosodiethylamine	µg/L	< 5.0	0.00		Acceptable	EPA 625
6530	N-Nitrosodimethylamine	µg/L	67.1	82.1	8.21 - 98.5	Acceptable	EPA 625
6535	N-Nitrosodiphenylamine	µg/L	< 5.0	0.00		Acceptable	EPA 625
6545	N-Nitroso-di-n-propylamine	µg/L	71.3	73.2	20.2 - 96.3	Acceptable	EPA 625
6590	Pentachlorobenzene	µg/L	< 5.0	0.00		Acceptable	EPA 625
6615	Phenanthrene	µg/L	53.0	70.8	33.4 - 86.8	Acceptable	EPA 625
6665	Pyrene	µg/L	22.3	33.5	10.8 - 49.5	Acceptable	EPA 625
5095	Pyridine	µg/L	< 2.0	0.00		Acceptable	EPA 625
6715	1,2,4,5-Tetrachlorobenzene	µg/L	< 5.0	0.00		Acceptable	EPA 625
5155	1,2,4-Trichlorobenzene	µg/L	49.5	57.4	11.4 - 71.0	Acceptable	EPA 625

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Base/Neutrals (cat# 833)							
5500	Acenaphthene	µg/L	14.4	18.2	8.77 - 23.9	Acceptable	EPA 8270C
5505	Acenaphthylene	µg/L	14.8	19.8	6.97 - 26.0	Acceptable	EPA 8270C
5145	2-Amino-1-methylbenzene (o-toluidine)	µg/L	< 5.0	0.00		Acceptable	EPA 8270C
5545	Aniline	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
5555	Anthracene	µg/L	40.6	58.5	25.0 - 74.0	Acceptable	EPA 8270C
5595	Benzidine	µg/L	< 20.0	0.00		Acceptable	EPA 8270C
5575	Benzo(a)anthracene	µg/L	< 1.0	0.00		Acceptable	EPA 8270C
5585	Benzo(b)fluoranthene	µg/L	15.6	21.8	6.58 - 31.2	Acceptable	EPA 8270C
5600	Benzo(k)fluoranthene	µg/L	20.2	25.6	5.37 - 40.7	Acceptable	EPA 8270C
5590	Benzo(g,h,i)perylene	µg/L	17.9	25.4	5.35 - 38.1	Acceptable	EPA 8270C
5580	Benzo(a)pyrene	µg/L	29.1	38.4	11.8 - 50.6	Acceptable	EPA 8270C
5630	Benzyl alcohol	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
5660	4-Bromophenyl-phenylether	µg/L	117	133	42.8 - 177	Acceptable	EPA 8270C
5670	Butylbenzylphthalate	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
5680	Carbazole	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
5745	4-Chloroaniline	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
5760	bis(2-Chloroethoxy)methane	µg/L	126	141	55.8 - 167	Acceptable	EPA 8270C
5765	bis(2-Chloroethyl)ether	µg/L	46.9	48.1	14.3 - 61.6	Acceptable	EPA 8270C
5780	bis(2-Chloroisopropyl)ether	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
5790	1-Chloronaphthalene	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
5795	2-Chloronaphthalene	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
5825	4-Chlorophenyl-phenylether	µg/L	126	124	46.4 - 154	Acceptable	EPA 8270C
5855	Chrysene	µg/L	10.5	15.0	7.11 - 23.0	Acceptable	EPA 8270C
5895	Dibenz(a,h)anthracene	µg/L	< 1.0	0.00		Acceptable	EPA 8270C
5905	Dibenzofuran	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
5925	Di-n-butylphthalate	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
4610	1,2-Dichlorobenzene	µg/L	129	141	18.1 - 166	Acceptable	EPA 8270C
4615	1,3-Dichlorobenzene	µg/L	118	129	15.6 - 149	Acceptable	EPA 8270C
4620	1,4-Dichlorobenzene	µg/L	28.4	32.8	3.28 - 43.6	Acceptable	EPA 8270C
5945	3,3'-Dichlorobenzidine	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
6070	Diethylphthalate	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
6135	Dimethylphthalate	µg/L	128	132	13.2 - 190	Acceptable	EPA 8270C

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 03/23/10
Study Dates: 01/18/10 - 03/04/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Base/Neutrals (cat# 833) (Continued)							
6185	2,4-Dinitrotoluene	µg/L	84.9	93.2	34.3 - 116	Acceptable	EPA 8270C
6190	2,6-Dinitrotoluene	µg/L	141	134	56.0 - 168	Acceptable	EPA 8270C
6200	Di-n-octylphthalate	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
6065	bis(2-Ethylhexyl)phthalate	µg/L	50.5	70.0	21.0 - 98.4	Acceptable	EPA 8270C
6265	Fluoranthene	µg/L	67.5	91.5	40.7 - 111	Acceptable	EPA 8270C
6270	Fluorene	µg/L	< 1.0	0.00		Acceptable	EPA 8270C
6275	Hexachlorobenzene	µg/L	68.2	98.6	42.9 - 121	Acceptable	EPA 8270C
4835	Hexachlorobutadiene	µg/L	94.3	95.4	10.6 - 115	Acceptable	EPA 8270C
6285	Hexachlorocyclopentadiene	µg/L	103	154	15.4 - 199	Acceptable	EPA 8270C
4840	Hexachloroethane	µg/L	78.8	88.9	9.22 - 105	Acceptable	EPA 8270C
6315	Indeno(1,2,3-cd)pyrene	µg/L	19.1	35.4	6.20 - 50.2	Acceptable	EPA 8270C
6320	Isophorone	µg/L	50.2	56.4	22.7 - 73.6	Acceptable	EPA 8270C
6385	2-Methylnaphthalene	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
5005	Naphthalene	µg/L	93.4	116	30.5 - 138	Acceptable	EPA 8270C
6460	2-Nitroaniline	µg/L	< 5.0	0.00		Acceptable	EPA 8270C
6465	3-Nitroaniline	µg/L	< 5.0	0.00		Acceptable	EPA 8270C
6470	4-Nitroaniline	µg/L	< 5.0	0.00		Acceptable	EPA 8270C
5015	Nitrobenzene	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
6525	N-Nitrosodiethylamine	µg/L	< 5.0	0.00		Acceptable	EPA 8270C
6530	N-Nitrosodimethylamine	µg/L	67.1	82.1	8.21 - 98.5	Acceptable	EPA 8270C
6535	N-Nitrosodiphenylamine	µg/L	< 5.0	0.00		Acceptable	EPA 8270C
6545	N-Nitroso-di-n-propylamine	µg/L	71.3	73.2	20.2 - 96.3	Acceptable	EPA 8270C
6590	Pentachlorobenzene	µg/L	< 5.0	0.00		Acceptable	EPA 8270C
6615	Phenanthrene	µg/L	53.0	70.8	33.4 - 86.8	Acceptable	EPA 8270C
6665	Pyrene	µg/L	22.3	33.5	10.8 - 49.5	Acceptable	EPA 8270C
5095	Pyridine	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
6715	1,2,4,5-Tetrachlorobenzene	µg/L	< 5.0	0.00		Acceptable	EPA 8270C
5155	1,2,4-Trichlorobenzene	µg/L	49.5	57.4	11.4 - 71.0	Acceptable	EPA 8270C

WP-180 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 03/23/10
Study Dates: 01/18/10 - 03/04/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Acids (cat# 834)							
5610	Benzoic acid	µg/L	< 20.0	0.00		Acceptable	EPA 625
5700	4-Chloro-3-methylphenol	µg/L	52.4	61.3	22.9 - 78.9	Acceptable	EPA 625
5800	2-Chlorophenol	µg/L	77.8	108	31.4 - 136	Acceptable	EPA 625
6000	2,4-Dichlorophenol	µg/L	75.4	95.7	30.4 - 119	Acceptable	EPA 625
6005	2,6-Dichlorophenol	µg/L	134	135	46.5 - 168	Acceptable	EPA 625
6130	2,4-Dimethylphenol	µg/L	60.9	68.5	13.1 - 90.8	Acceptable	EPA 625
6360	4,6-Dinitro-2-methylphenol	µg/L	94.2	162	58.2 - 232	Acceptable	EPA 625
6175	2,4-Dinitrophenol	µg/L	85.3	138	13.8 - 190	Acceptable	EPA 625
6400	2-Methylphenol	µg/L	47.5	57.0	10.8 - 72.0	Acceptable	EPA 625
6410	4-Methylphenol	µg/L	81.9	106	10.6 - 138	Acceptable	EPA 625
6490	2-Nitrophenol	µg/L	52.2	70.5	20.0 - 89.6	Acceptable	EPA 625
6500	4-Nitrophenol	µg/L	128	148	14.8 - 199	Acceptable	EPA 625
6605	Pentachlorophenol	µg/L	82.5	151	41.4 - 209	Acceptable	EPA 625
6625	Phenol	µg/L	75.8	113	11.3 - 152	Acceptable	EPA 625
6735	2,3,4,6-Tetrachlorophenol	µg/L	95.7	153	34.4 - 206	Acceptable	EPA 625
6835	2,4,5-Trichlorophenol	µg/L	55.1	52.4	20.4 - 70.4	Acceptable	EPA 625
6840	2,4,6-Trichlorophenol	µg/L	63.3	64.5	20.6 - 83.4	Acceptable	EPA 625
WP Acids (cat# 834)							
5610	Benzoic acid	µg/L	< 20.0	0.00		Acceptable	EPA 8270C
5700	4-Chloro-3-methylphenol	µg/L	52.4	61.3	22.9 - 78.9	Acceptable	EPA 8270C
5800	2-Chlorophenol	µg/L	77.8	108	31.4 - 136	Acceptable	EPA 8270C
6000	2,4-Dichlorophenol	µg/L	75.4	95.7	30.4 - 119	Acceptable	EPA 8270C
6005	2,6-Dichlorophenol	µg/L	134	135	46.5 - 168	Acceptable	EPA 8270C
6130	2,4-Dimethylphenol	µg/L	60.9	68.5	13.1 - 90.8	Acceptable	EPA 8270C
6360	4,6-Dinitro-2-methylphenol	µg/L	94.2	162	58.2 - 232	Acceptable	EPA 8270C
6175	2,4-Dinitrophenol	µg/L	85.3	138	13.8 - 190	Acceptable	EPA 8270C
6400	2-Methylphenol	µg/L	47.5	57.0	10.8 - 72.0	Acceptable	EPA 8270C
6410	4-Methylphenol	µg/L	81.9	106	10.6 - 138	Acceptable	EPA 8270C
6490	2-Nitrophenol	µg/L	52.2	70.5	20.0 - 89.6	Acceptable	EPA 8270C
6500	4-Nitrophenol	µg/L	128	148	14.8 - 199	Acceptable	EPA 8270C
6605	Pentachlorophenol	µg/L	82.5	151	41.4 - 209	Acceptable	EPA 8270C
6625	Phenol	µg/L	75.8	113	11.3 - 152	Acceptable	EPA 8270C
6735	2,3,4,6-Tetrachlorophenol	µg/L	95.7	153	34.4 - 206	Acceptable	EPA 8270C
6835	2,4,5-Trichlorophenol	µg/L	55.1	52.4	20.4 - 70.4	Acceptable	EPA 8270C
6840	2,4,6-Trichlorophenol	µg/L	63.3	64.5	20.6 - 83.4	Acceptable	EPA 8270C

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

WP-180 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 03/23/10
Study Dates: 01/18/10 - 03/04/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Low-Level PAHs (cat# 836)							
5500	Acenaphthene	µg/L	4.78	6.64	3.38 - 7.87	Acceptable	EPA 8310 UV
5505	Acenaphthylene	µg/L	3.77	5.64	2.74 - 6.73	Acceptable	EPA 8310 UV
5555	Anthracene	µg/L	0.782	0.907	0.258 - 1.26	Acceptable	EPA 8310 UV
5575	Benzo(a)anthracene	µg/L	0.415	0.469	0.229 - 0.625	Acceptable	EPA 8310 UV
5585	Benzo(b)fluoranthene	µg/L	1.16	1.24	0.533 - 1.54	Acceptable	EPA 8310 UV
5600	Benzo(k)fluoranthene	µg/L	1.41	1.47	0.821 - 1.77	Acceptable	EPA 8310 UV
5590	Benzo(g,h,i)perylene	µg/L	1.68	1.86	0.631 - 2.43	Acceptable	EPA 8310 UV
5580	Benzo(a)pyrene	µg/L	1.64	1.74	0.740 - 2.10	Acceptable	EPA 8310 UV
5855	Chrysene	µg/L	0.297	0.338	0.182 - 0.461	Acceptable	EPA 8310 UV
5895	Dibenz(a,h)anthracene	µg/L	1.05	1.32	0.407 - 1.81	Acceptable	EPA 8310 UV
6265	Fluoranthene	µg/L	1.68	1.88	1.12 - 2.24	Acceptable	EPA 8310 UV
6270	Fluorene	µg/L	4.68	5.38	2.31 - 6.36	Acceptable	EPA 8310 UV
6315	Indeno(1,2,3-cd)pyrene	µg/L	1.44	1.53	0.699 - 1.90	Acceptable	EPA 8310 UV
5005	Naphthalene	µg/L	4.22	5.94	2.15 - 6.53	Acceptable	EPA 8310 UV
6615	Phenanthrene	µg/L	0.889	1.01	0.509 - 1.24	Acceptable	EPA 8310 UV
6665	Pyrene	µg/L	0.653	0.779	0.440 - 0.969	Acceptable	EPA 8310 UV
WP Organochlorine Pesticides (cat# 831)							
0047	Aldrin	µg/L	4.0	3.48	0.995 - 4.82	Acceptable	EPA 608
7110	alpha-BHC	µg/L	3.6	3.05	1.11 - 4.34	Acceptable	EPA 608
7115	beta-BHC	µg/L	4.5	3.93	1.60 - 5.48	Acceptable	EPA 608
7105	delta-BHC	µg/L	10.7	9.06	3.41 - 12.6	Acceptable	EPA 608
7120	gamma-BHC(Lindane)	µg/L	8.0	6.43	2.62 - 8.88	Acceptable	EPA 608
7240	alpha-Chlordane	µg/L	6.5	5.78	2.60 - 7.82	Acceptable	EPA 608
7245	gamma-Chlordane	µg/L	4.2	3.71	1.56 - 5.11	Acceptable	EPA 608
0049	4,4'-DDD	µg/L	6.8	5.80	2.16 - 8.31	Acceptable	EPA 608
0050	4,4'-DDE	µg/L	3.7	3.34	1.45 - 4.43	Acceptable	EPA 608
0051	4,4'-DDT	µg/L	1.9	1.53	0.578 - 2.33	Acceptable	EPA 608
0048	Dieldrin	µg/L	10.8	9.60	4.72 - 13.0	Acceptable	EPA 608
7540	Endrin	µg/L	5.4	4.83	1.80 - 7.28	Acceptable	EPA 608
7530	Endrin aldehyde	µg/L	7.1	5.98	1.60 - 9.30	Acceptable	EPA 608
7535	Endrin ketone	µg/L	6.7	5.49	3.02 - 7.96	Acceptable	EPA 608
7510	Endosulfan I	µg/L	11.4	13.6	4.16 - 19.9	Acceptable	EPA 608
7515	Endosulfan II	µg/L	8.9	8.69	2.79 - 11.7	Acceptable	EPA 608
7520	Endosulfan sulfate	µg/L	11.3	9.83	3.71 - 14.3	Acceptable	EPA 608
0052	Heptachlor	µg/L	4.8	4.30	1.40 - 5.91	Acceptable	EPA 608
0078	Heptachlor epoxide (beta)	µg/L	10.9	9.69	4.86 - 13.5	Acceptable	EPA 608
7810	Methoxychlor	µg/L	13.0	11.7	3.15 - 18.4	Acceptable	EPA 608

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

WP-180 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 03/23/10
Study Dates: 01/18/10 - 03/04/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Organochlorine Pesticides (cat# 831)							
0047	Aldrin	µg/L	4.0	3.48	0.995 - 4.82	Acceptable	EPA 8081A
7110	alpha-BHC	µg/L	3.6	3.05	1.11 - 4.34	Acceptable	EPA 8081A
7115	beta-BHC	µg/L	4.5	3.93	1.60 - 5.48	Acceptable	EPA 8081A
7105	delta-BHC	µg/L	10.7	9.06	3.41 - 12.6	Acceptable	EPA 8081A
7120	gamma-BHC(Lindane)	µg/L	8.0	6.43	2.62 - 8.88	Acceptable	EPA 8081A
7240	alpha-Chlordane	µg/L	6.5	5.78	2.60 - 7.82	Acceptable	EPA 8081A
7245	gamma-Chlordane	µg/L	4.2	3.71	1.56 - 5.11	Acceptable	EPA 8081A
0049	4,4'-DDD	µg/L	6.8	5.80	2.16 - 8.31	Acceptable	EPA 8081A
0050	4,4'-DDE	µg/L	3.7	3.34	1.45 - 4.43	Acceptable	EPA 8081A
0051	4,4'-DDT	µg/L	1.9	1.53	0.578 - 2.33	Acceptable	EPA 8081A
0048	Dieldrin	µg/L	10.8	9.60	4.72 - 13.0	Acceptable	EPA 8081A
7540	Endrin	µg/L	5.4	4.83	1.80 - 7.28	Acceptable	EPA 8081A
7530	Endrin aldehyde	µg/L	7.1	5.98	1.60 - 9.30	Acceptable	EPA 8081A
7535	Endrin ketone	µg/L	6.7	5.49	3.02 - 7.96	Acceptable	EPA 8081A
7510	Endosulfan I	µg/L	11.4	13.6	4.16 - 19.9	Acceptable	EPA 8081A
7515	Endosulfan II	µg/L	8.9	8.69	2.79 - 11.7	Acceptable	EPA 8081A
7520	Endosulfan sulfate	µg/L	11.3	9.83	3.71 - 14.3	Acceptable	EPA 8081A
0052	Heptachlor	µg/L	4.8	4.30	1.40 - 5.91	Acceptable	EPA 8081A
0078	Heptachlor epoxide (beta)	µg/L	10.9	9.69	4.86 - 13.5	Acceptable	EPA 8081A
7810	Methoxychlor	µg/L	13.0	11.7	3.15 - 18.4	Acceptable	EPA 8081A
WP Chlordane (cat# 837)							
0053	Chlordane, technical	µg/L	17.3	17.2	6.46 - 24.8	Acceptable	EPA 608
WP Chlordane (cat# 837)							
0053	Chlordane, technical	µg/L	17.3	17.2	6.46 - 24.8	Acceptable	EPA 8081A
WP Toxaphene (cat# 838)							
8250	Toxaphene	µg/L	21.3	20.8	2.08 - 37.7	Acceptable	EPA 608
WP Toxaphene (cat# 838)							
8250	Toxaphene	µg/L	21.3	20.8	2.08 - 37.7	Acceptable	EPA 8081A
WP Total Organic Halides (TOX) (cat# 895)							
2045	Total Organic Halides (TOX)	µg/L	977	969	755 - 1120	Acceptable	EPA 9020B

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

Phillip Worby
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810

WP-186 Final Report

WatR™ Pollution Proficiency Testing

WatR™ Pollution Study

Open Date: 07/20/10

Close Date: 09/03/10

Report Issued Date: 09/24/10

September 24, 2010

Phillip Worby
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810

Enclosed is your final report for ERA's WP-186 WatR™Pollution Proficiency Testing (PT) study. Your final report includes an evaluation of all results submitted by your laboratory to ERA.

Data Evaluation Protocols: All analytes in ERA's WP-186 WatR™Pollution Proficiency Testing study have been evaluated using the following tiered approach. If the analyte is listed in the most current National Environmental Laboratory Accreditation Conference (NELAC) PT Field of Testing tables, the evaluation was completed by comparing the reported result to the acceptance limits generated using the criteria contained in the NELAC FoPT tables. If the analyte is not included in the NELAC FoPT tables, the reported result has been evaluated using the procedures outlined in ERA's Standard Operating Procedure for the Generation of Performance Acceptance Limits (SOP 0260).

Corrective Action Help: As part of your accreditation(s), you may be required to identify the root cause of any "Not Acceptable" results, implement the necessary corrective actions, and then satisfy your PT requirements by participating in a Supplemental (QuiK™ Response) or future ERA PT study. ERA's technical staff is available to help your laboratory resolve any technical issues that may be impairing your PT performance and possibly affecting your routine data quality. Our laboratory and technical staff have well over three hundred years of collective experience in performing the full range of environmental analyses. As part of our technical support, ERA offers QC samples that can be helpful in helping you work through your technical issues.

Thank you for your participation in ERA's WP-186 WatR™Pollution Proficiency Testing study. If you have any questions, please contact the proficiency testing department or myself at 1-800-372-0122.

Sincerely,

Jay R. McBurney
Quality Program Manager

attachments
jrm

Report Recipient	Contact/Phone Number	Reporting Type
DoD EDQW	Fred S McLean / 843-764-7266	All Analytes
Massachusetts	Ann Marie Allen / 978-682-5237 x 333	All Analytes
Minnesota	Susan Wyatt / 651-201-5323	All Analytes
New Jersey	Rachel Ellis / 609-777-1749	All Analytes
Ohio (WP)	Darlene Stanley / 614-644-3748	All Analytes
Oklahoma	David Caldwell / 405-702-1039	All Analytes
South Carolina	Carol Smith / 803-896-0992	All Analytes
West Virginia (DEP)	Daniel T. Arnold / 304-926-0499 x1341	All Analytes
Enovis	Tim Abston / 313-872-6151	All Analytes

WP-186 Definitions & Study Discussion

Study Dates: 07/20/10 - 09/03/10 **Report Issued: 09/24/10**

WP Study Definitions

The Reported Value is the value that the laboratory reported to ERA.

The ERA Assigned Values are compliant with the most current USEPA/NELAC FoPT tables. A parameter not added to the standard is given an Assigned Value of "0" per the guidelines contained in the USEPA's Criteria Document and NELAC standards.

The Acceptance Limits are established per the criteria contained in the most current USEPA/NELAC FoPT tables, or ERA's SOP for the Generation of Performance Acceptance Limits™ as applicable.

The Performance Evaluation:

Acceptable	= Reported Value falls within the Acceptance Limits.
Not Acceptable	= Reported Value falls outside the Acceptance Limits.
No Evaluation	= Reported Value cannot be evaluated.
Not Reported	= No Value reported.

The Method Description is the method the laboratory reported to ERA.

WP Study Discussion

ERA's WP-186 WatR™Pollution Proficiency Testing study has been reviewed by ERA senior management and certified compliant with the requirements of the USEPA's National Standards for Water Proficiency Testing Studies Criteria Document (December 1998), and the criteria contained in the most current NELAC FoPT tables.

ERA's WP-186 WatR™Pollution study standards were examined for any anomalies. A full review of all homogeneity, stability and accuracy verification data was completed. All analytical verification data for all analytes met the acceptance criteria contained in the USEPA's National Criteria Document for Water Proficiency Testing Studies, December 1998, and the criteria contained in the most current NELAC FoPT tables.

The data submitted by participating laboratories was also examined for study anomalies. There were no anomalies observed during the statistical review of the data.

If you have any questions or concerns regarding your assessment in ERA's WatR™Pollution Proficiency Testing program, please contact Jay McBurney, Quality Program Manager, or the proficiency testing department at 1-800-372-0122.

Study: **WP-186**

ERA Customer Number: **A064801**

Laboratory Name: **Accutest Mid Atlantic**

Inorganic Results

WP-186 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 09/24/10
Study Dates: 07/20/10 - 09/03/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Minerals (cat# 581)							
0027	Alkalinity as CaCO3	mg/L	67.1	70.8	62.2 - 78.8	Acceptable	SM2320B
0028	Chloride	mg/L	59.5	61.1	52.1 - 70.6	Acceptable	EPA 300.0
0020	Conductivity at 25°C	µmhos/cm	373	369	329 - 409	Acceptable	SM2510B
0029	Fluoride	mg/L	2.92	3.10	2.59 - 3.62	Acceptable	EPA 300.0
0026	Potassium	mg/L	16.1	16.4	13.4 - 19.6	Acceptable	EPA 200.7
0025	Sodium	mg/L	69.3	70.7	60.0 - 81.1	Acceptable	EPA 200.7
0030	Sulfate	mg/L	12.3	12.3	9.04 - 15.3	Acceptable	EPA 300.0
0021	Total Dissolved Solids at 180°C	mg/L	253	271	202 - 340	Acceptable	SM2540C
1950	Total Solids at 105°C	mg/L	275	291	251 - 327	Acceptable	SM2540G
WP Minerals (cat# 581)							
0027	Alkalinity as CaCO3	mg/L		70.8	62.2 - 78.8	Not Reported	
0028	Chloride	mg/L	59.5	61.1	52.1 - 70.6	Acceptable	EPA 9056
0020	Conductivity at 25°C	µmhos/cm	373	369	329 - 409	Acceptable	EPA 9050A
0029	Fluoride	mg/L	2.92	3.10	2.59 - 3.62	Acceptable	EPA 9056
0026	Potassium	mg/L	15.7	16.4	13.4 - 19.6	Acceptable	EPA 200.8
0025	Sodium	mg/L	69.7	70.7	60.0 - 81.1	Acceptable	EPA 200.8
0030	Sulfate	mg/L	12.3	12.3	9.04 - 15.3	Acceptable	EPA 9056
0021	Total Dissolved Solids at 180°C	mg/L		271	202 - 340	Not Reported	
1950	Total Solids at 105°C	mg/L		291	251 - 327	Not Reported	
WP Minerals (cat# 581)							
0027	Alkalinity as CaCO3	mg/L		70.8	62.2 - 78.8	Not Reported	
0028	Chloride	mg/L	57.5	61.1	52.1 - 70.6	Acceptable	SM4500Cl- C VIS
0020	Conductivity at 25°C	µmhos/cm		369	329 - 409	Not Reported	
0029	Fluoride	mg/L		3.10	2.59 - 3.62	Not Reported	
0026	Potassium	mg/L	15.7	16.4	13.4 - 19.6	Acceptable	EPA 6010B
0025	Sodium	mg/L	69.0	70.7	60.0 - 81.1	Acceptable	EPA 6010B
0030	Sulfate	mg/L		12.3	9.04 - 15.3	Not Reported	
0021	Total Dissolved Solids at 180°C	mg/L		271	202 - 340	Not Reported	
1950	Total Solids at 105°C	mg/L	275	291	251 - 327	Acceptable	SM2540B
WP Minerals (cat# 581)							
0027	Alkalinity as CaCO3	mg/L		70.8	62.2 - 78.8	Not Reported	
0028	Chloride	mg/L		61.1	52.1 - 70.6	Not Reported	
0020	Conductivity at 25°C	µmhos/cm		369	329 - 409	Not Reported	
0029	Fluoride	mg/L		3.10	2.59 - 3.62	Not Reported	
0026	Potassium	mg/L	15.9	16.4	13.4 - 19.6	Acceptable	EPA 6020
0025	Sodium	mg/L	70.5	70.7	60.0 - 81.1	Acceptable	EPA 6020
0030	Sulfate	mg/L		12.3	9.04 - 15.3	Not Reported	
0021	Total Dissolved Solids at 180°C	mg/L		271	202 - 340	Not Reported	
1950	Total Solids at 105°C	mg/L		291	251 - 327	Not Reported	

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

WP-186 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 09/24/10
Study Dates: 07/20/10 - 09/03/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Hardness (cat# 580)							
0072	Non-Filterable Residue (TSS)	mg/L	44.0	45.1	34.4 - 52.0	Acceptable	SM2540D
0023	Calcium	mg/L	48.4	49.8	44.4 - 56.5	Acceptable	EPA 200.7
0024	Magnesium	mg/L	20.9	21.9	18.7 - 25.1	Acceptable	EPA 200.7
1550	Calcium Hardness as CaCO3	mg/L	121	124	111 - 141	Acceptable	EPA 200.7
0022	Total Hardness as CaCO3	mg/L	204	214	188 - 245	Acceptable	SM2340C
WP Hardness (cat# 580)							
0072	Non-Filterable Residue (TSS)	mg/L		45.1	34.4 - 52.0	Not Reported	
0023	Calcium	mg/L	55.3	49.8	44.4 - 56.5	Acceptable	EPA 200.8
0024	Magnesium	mg/L	21.6	21.9	18.7 - 25.1	Acceptable	EPA 200.8
1550	Calcium Hardness as CaCO3	mg/L	121	124	111 - 141	Acceptable	SM2340B
0022	Total Hardness as CaCO3	mg/L		214	188 - 245	Not Reported	
WP Hardness (cat# 580)							
0072	Non-Filterable Residue (TSS)	mg/L		45.1	34.4 - 52.0	Not Reported	
0023	Calcium	mg/L	46.5	49.8	44.4 - 56.5	Acceptable	EPA 6010B
0024	Magnesium	mg/L	20.0	21.9	18.7 - 25.1	Acceptable	EPA 6010B
1550	Calcium Hardness as CaCO3	mg/L		124	111 - 141	Not Reported	
0022	Total Hardness as CaCO3	mg/L		214	188 - 245	Not Reported	
WP Hardness (cat# 580)							
0072	Non-Filterable Residue (TSS)	mg/L		45.1	34.4 - 52.0	Not Reported	
0023	Calcium	mg/L	54.1	49.8	44.4 - 56.5	Acceptable	EPA 6020
0024	Magnesium	mg/L	20.7	21.9	18.7 - 25.1	Acceptable	EPA 6020
1550	Calcium Hardness as CaCO3	mg/L		124	111 - 141	Not Reported	
0022	Total Hardness as CaCO3	mg/L		214	188 - 245	Not Reported	
WP pH (cat# 577)							
0019	pH	S.U.	7.10	7.11	6.91 - 7.31	Acceptable	SM4500H+ B
WP Settleable Solids (cat# 883)							
1965	Settleable Solids	mL/L	24.0	23.7	18.4 - 30.5	Acceptable	SM2540F
WP Volatile Solids (cat# 884)							
1970	Volatile Solids	mg/L	310	341	283 - 377	Acceptable	EPA 160.4
WP Volatile Solids (cat# 884)							
1970	Volatile Solids	mg/L	310	341	283 - 377	Acceptable	SM2540G
WP Simple Nutrients (cat# 584)							
0031	Ammonia as N	mg/L	13.7	16.0	11.9 - 19.8	Acceptable	SM4500NH3 G
1820	Nitrate + Nitrite as N	mg/L	30.9	28.7	23.4 - 33.3	Acceptable	EPA 353.2
0032	Nitrate as N	mg/L	30.9	28.7	22.4 - 34.6	Acceptable	EPA 353.2
0033	ortho-Phosphate as P	mg/L	3.86	3.98	3.27 - 4.72	Acceptable	SM4500P E

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WP-186 Final Complete Report

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Complex Nutrients (cat# 579)							
0034	Total Kjeldahl Nitrogen	mg/L	18.6	18.5	12.2 - 23.8	Acceptable	EPA 351.2
0035	Total phosphorus as P	mg/L	2.88	2.89	2.34 - 3.49	Acceptable	EPA 365.3
WP Nitrite (cat# 888)							
1840	Nitrite as N	mg/L	2.61	2.66	2.25 - 3.07	Acceptable	SM4500NO2- B
WP Demand (cat# 578)							
0038	BOD	mg/L	100	79.7	40.2 - 119	Acceptable	SM5210B
0102	CBOD	mg/L	77.1	68.6	30.8 - 106	Acceptable	SM5210B
0036	COD	mg/L	123	129	97.7 - 149	Acceptable	SM5220C
0037	TOC	mg/L	49.0	50.8	42.4 - 58.6	Acceptable	SM5310B
WP Demand (cat# 578)							
0038	BOD	mg/L		79.7	40.2 - 119	Not Reported	
0102	CBOD	mg/L		68.6	30.8 - 106	Not Reported	
0036	COD	mg/L		129	97.7 - 149	Not Reported	
0037	TOC	mg/L	49.0	50.8	42.4 - 58.6	Acceptable	EPA 9060
WP Oil & Grease (cat# 582)							
0104	Oil & Grease (Gravimetric)	mg/L	32.5	36.0	21.3 - 45.6	Acceptable	EPA 1664A
1860	Oil & Grease (Infrared)	mg/L		44.3	27.8 - 54.7	Not Reported	
WP Trace Metals (cat# 586)							
0001	Aluminum	µg/L	996	984	792 - 1170	Acceptable	EPA 200.7
0016	Antimony	µg/L	537	525	367 - 632	Acceptable	EPA 200.7
0002	Arsenic	µg/L	587	579	486 - 678	Acceptable	EPA 200.7
1015	Barium	µg/L	1800	1740	1510 - 1960	Acceptable	EPA 200.7
0003	Beryllium	µg/L	245	245	208 - 277	Acceptable	EPA 200.7
1025	Boron	µg/L	889	829	688 - 967	Acceptable	EPA 200.7
0004	Cadmium	µg/L	711	685	585 - 777	Acceptable	EPA 200.7
0006	Chromium	µg/L	472	448	390 - 507	Acceptable	EPA 200.7
0005	Cobalt	µg/L	1020	938	825 - 1050	Acceptable	EPA 200.7
0007	Copper	µg/L	813	833	750 - 916	Acceptable	EPA 200.7
0008	Iron	µg/L	563	519	456 - 590	Acceptable	EPA 200.7
0012	Lead	µg/L	521	496	431 - 559	Acceptable	EPA 200.7
0010	Manganese	µg/L	1140	1070	961 - 1190	Acceptable	EPA 200.7
0074	Molybdenum	µg/L	562	537	456 - 612	Acceptable	EPA 200.7
0011	Nickel	µg/L	290	276	244 - 312	Acceptable	EPA 200.7
0013	Selenium	µg/L	543	516	408 - 598	Acceptable	EPA 200.7
0017	Silver	µg/L	233	233	200 - 267	Acceptable	EPA 200.7
0075	Strontium	µg/L	53.2	50.5	41.0 - 59.8	Acceptable	EPA 200.7
0018	Thallium	µg/L	828	761	626 - 904	Acceptable	EPA 200.7
0014	Vanadium	µg/L	733	719	630 - 804	Acceptable	EPA 200.7
0015	Zinc	µg/L	806	717	616 - 825	Acceptable	EPA 200.7

ACCREDITED Lab Code 1539-01

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WP-186 Final Complete Report

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Trace Metals (cat# 586)							
0001	Aluminum	µg/L	995	984	792 - 1170	Acceptable	EPA 200.8
0016	Antimony	µg/L	558	525	367 - 632	Acceptable	EPA 200.8
0002	Arsenic	µg/L	577	579	486 - 678	Acceptable	EPA 200.8
1015	Barium	µg/L	1800	1740	1510 - 1960	Acceptable	EPA 200.8
0003	Beryllium	µg/L	235	245	208 - 277	Acceptable	EPA 200.8
1025	Boron	µg/L		829	688 - 967	Not Reported	
0004	Cadmium	µg/L	681	685	585 - 777	Acceptable	EPA 200.8
0006	Chromium	µg/L	450	448	390 - 507	Acceptable	EPA 200.8
0005	Cobalt	µg/L	969	938	825 - 1050	Acceptable	EPA 200.8
0007	Copper	µg/L	858	833	750 - 916	Acceptable	EPA 200.8
0008	Iron	µg/L	523	519	456 - 590	Acceptable	EPA 200.8
0012	Lead	µg/L	508	496	431 - 559	Acceptable	EPA 200.8
0010	Manganese	µg/L	1110	1070	961 - 1190	Acceptable	EPA 200.8
0074	Molybdenum	µg/L	533	537	456 - 612	Acceptable	EPA 200.8
0011	Nickel	µg/L	270	276	244 - 312	Acceptable	EPA 200.8
0013	Selenium	µg/L	508	516	408 - 598	Acceptable	EPA 200.8
0017	Silver	µg/L	238	233	200 - 267	Acceptable	EPA 200.8
0075	Strontium	µg/L	49.8	50.5	41.0 - 59.8	Acceptable	EPA 200.8
0018	Thallium	µg/L	798	761	626 - 904	Acceptable	EPA 200.8
0014	Vanadium	µg/L	737	719	630 - 804	Acceptable	EPA 200.8
0015	Zinc	µg/L	738	717	616 - 825	Acceptable	EPA 200.8

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Trace Metals (cat# 586)							
0001	Aluminum	µg/L	1010	984	792 - 1170	Acceptable	EPA 6020
0016	Antimony	µg/L	548	525	367 - 632	Acceptable	EPA 6020
0002	Arsenic	µg/L	572	579	486 - 678	Acceptable	EPA 6020
1015	Barium	µg/L	1790	1740	1510 - 1960	Acceptable	EPA 6020
0003	Beryllium	µg/L	241	245	208 - 277	Acceptable	EPA 6020
1025	Boron	µg/L		829	688 - 967	Not Reported	
0004	Cadmium	µg/L	694	685	585 - 777	Acceptable	EPA 6020
0006	Chromium	µg/L	461	448	390 - 507	Acceptable	EPA 6020
0005	Cobalt	µg/L	1060	938	825 - 1050	Not Acceptable	EPA 6020
0007	Copper	µg/L	822	833	750 - 916	Acceptable	EPA 6020
0008	Iron	µg/L	544	519	456 - 590	Acceptable	EPA 6020
0012	Lead	µg/L	512	496	431 - 559	Acceptable	EPA 6020
0010	Manganese	µg/L	1170	1070	961 - 1190	Acceptable	EPA 6020
0074	Molybdenum	µg/L	547	537	456 - 612	Acceptable	EPA 6020
0011	Nickel	µg/L	285	276	244 - 312	Acceptable	EPA 6020
0013	Selenium	µg/L	493	516	408 - 598	Acceptable	EPA 6020
0017	Silver	µg/L	247	233	200 - 267	Acceptable	EPA 6020
0075	Strontium	µg/L	49.9	50.5	41.0 - 59.8	Acceptable	EPA 6020
0018	Thallium	µg/L	818	761	626 - 904	Acceptable	EPA 6020
0014	Vanadium	µg/L	746	719	630 - 804	Acceptable	EPA 6020
0015	Zinc	µg/L	723	717	616 - 825	Acceptable	EPA 6020

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Trace Metals (cat# 586)							
0001	Aluminum	µg/L	976	984	792 - 1170	Acceptable	EPA 6010B
0016	Antimony	µg/L	532	525	367 - 632	Acceptable	EPA 6010B
0002	Arsenic	µg/L	568	579	486 - 678	Acceptable	EPA 6010B
1015	Barium	µg/L	1790	1740	1510 - 1960	Acceptable	EPA 6010B
0003	Beryllium	µg/L	245	245	208 - 277	Acceptable	EPA 6010B
1025	Boron	µg/L	836	829	688 - 967	Acceptable	EPA 6010B
0004	Cadmium	µg/L	686	685	585 - 777	Acceptable	EPA 6010B
0006	Chromium	µg/L	464	448	390 - 507	Acceptable	EPA 6010B
0005	Cobalt	µg/L	1010	938	825 - 1050	Acceptable	EPA 6010B
0007	Copper	µg/L	811	833	750 - 916	Acceptable	EPA 6010B
0008	Iron	µg/L	563	519	456 - 590	Acceptable	EPA 6010B
0012	Lead	µg/L	481	496	431 - 559	Acceptable	EPA 6010B
0010	Manganese	µg/L	1130	1070	961 - 1190	Acceptable	EPA 6010B
0074	Molybdenum	µg/L	570	537	456 - 612	Acceptable	EPA 6010B
0011	Nickel	µg/L	268	276	244 - 312	Acceptable	EPA 6010B
0013	Selenium	µg/L	515	516	408 - 598	Acceptable	EPA 6010B
0017	Silver	µg/L	218	233	200 - 267	Acceptable	EPA 6010B
0075	Strontium	µg/L	53.1	50.5	41.0 - 59.8	Acceptable	EPA 6010B
0018	Thallium	µg/L	763	761	626 - 904	Acceptable	EPA 6010B
0014	Vanadium	µg/L	701	719	630 - 804	Acceptable	EPA 6010B
0015	Zinc	µg/L	733	717	616 - 825	Acceptable	EPA 6010B
WP Mercury (cat# 574)							
0009	Mercury	µg/L	5.85	6.54	4.04 - 8.94	Acceptable	EPA 7470A
WP Mercury (cat# 574)							
0009	Mercury	µg/L	5.85	6.54	4.04 - 8.94	Acceptable	EPA 245.1
WP Hexavalent Chromium (cat# 898)							
1045	Hexavalent Chromium	µg/L	506	546	444 - 642	Acceptable	EPA 7196A
WP Hexavalent Chromium (cat# 898)							
1045	Hexavalent Chromium	µg/L	530	546	444 - 642	Acceptable	EPA 7199
WP Hexavalent Chromium (cat# 898)							
1045	Hexavalent Chromium	µg/L	524	546	444 - 642	Acceptable	SM3500Cr D
WP Tin & Titanium (cat# 573)							
1175	Tin	µg/L	3770	3650	2870 - 4450	Acceptable	EPA 200.7
0076	Titanium	µg/L	174	170	146 - 192	Acceptable	EPA 200.7
WP Tin & Titanium (cat# 573)							
1175	Tin	µg/L	3790	3650	2870 - 4450	Acceptable	EPA 200.8
0076	Titanium	µg/L	170	170	146 - 192	Acceptable	EPA 200.8

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Tin & Titanium (cat# 573)							
1175	Tin	µg/L	3810	3650	2870 - 4450	Acceptable	EPA 6010B
0076	Titanium	µg/L	173	170	146 - 192	Acceptable	EPA 6010B
WP Tin & Titanium (cat# 573)							
1175	Tin	µg/L	3620	3650	2870 - 4450	Acceptable	EPA 6020
0076	Titanium	µg/L	165	170	146 - 192	Acceptable	EPA 6020
WP Color (cat# 882)							
1605	Color	PC units	35	30.0	20.0 - 40.0	Acceptable	SM2120B
WP Turbidity (cat# 893)							
2055	Turbidity	NTU	4.49	5.07	4.17 - 5.90	Acceptable	EPA 180.1
WP Total Cyanide (cat# 588)							
0071	Cyanide, total	mg/L	0.743	0.739	0.464 - 1.01	Acceptable	EPA 335.4
WP Total Phenolics (4-AAP) (cat# 589)							
0097	Phenolics, total	mg/L	0.353	0.357	0.190 - 0.523	Acceptable	EPA 420.4
WP Silica (cat# 890)							
1990	Silica as SiO2	mg/L	70.4	67.9	50.9 - 84.9	Acceptable	EPA 200.7
WP Silica (cat# 890)							
1990	Silica as SiO2	mg/L	62.6	67.9	50.9 - 84.9	Acceptable	SM4500Si D
WP Sulfide (cat# 891)							
2005	Sulfide	mg/L	8.39	9.40	4.71 - 13.2	Acceptable	SM4500S2- F
WP Surfactants - MBAS (cat# 892)							
2025	Surfactants (MBAS)	mg/L	0.596	0.550	0.334 - 0.799	Acceptable	SM5540C
WP Acidity (cat# 885)							
1500	Acidity as CaCO3	mg/L	871	902	796 - 992	Acceptable	SM2310B
WP Bromide (cat# 887)							
1540	Bromide	mg/L	3.07	3.43	2.92 - 3.94	Acceptable	EPA 9056
WP Bromide (cat# 887)							
1540	Bromide	mg/L	3.07	3.43	2.92 - 3.94	Acceptable	EPA 300.0
WP Total Residual Chlorine (cat# 587)							
0098	Total Residual Chlorine	mg/L	1.54	1.35	0.969 - 1.67	Acceptable	SM4500Cl F

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Study: **WP-186**

ERA Customer Number: **A064801**

Laboratory Name: **Accutest Mid Atlantic**

Microbiology Results

WP-186 Final Complete Report

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WP WasteWatR™ Coliform MicrobE™ (cat# 576)							
2500	Total Coliforms (MF)	CFU/100mL	765	561	139 - 2270	Acceptable	SM9222B
2530	Fecal Coliforms (MF)	CFU/100mL	465	319	63.0 - 1620	Acceptable	SM9222D m FC
2525	E.coli (MF)	CFU/100mL		401	70.8 - 2270	Not Reported	
2500	Total Coliforms (MPN)	MPN/100mL		881	147 - 5290	Not Reported	
2530	Fecal Coliforms (MPN)	MPN/100mL		660	58.8 - 7420	Not Reported	
2525	E.coli (MPN)	MPN/100mL		1110	461 - 2680	Not Reported	

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Study: **WP-186**

ERA Customer Number: **A064801**

Laboratory Name: **Accutest Mid Atlantic**

Organic Results

WP-186 Final Complete Report

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Volatiles (cat# 830)							
4315	Acetone	µg/L	< 5.0	0.00		Acceptable	EPA 624
4320	Acetonitrile	µg/L	< 2.0	0.00		Acceptable	EPA 624
4325	Acrolein	µg/L	< 50	0.00		Acceptable	EPA 624
4340	Acrylonitrile	µg/L	< 10	0.00		Acceptable	EPA 624
0065	Benzene	µg/L	20.3	20.0	13.6 - 26.4	Acceptable	EPA 624
0060	Bromodichloromethane	µg/L	19.7	20.1	13.8 - 27.0	Acceptable	EPA 624
0062	Bromoform	µg/L	25.3	30.2	18.6 - 41.2	Acceptable	EPA 624
4950	Bromomethane	µg/L	< 1.0	0.00		Acceptable	EPA 624
4410	2-Butanone (MEK)	µg/L	110	110	32.0 - 172	Acceptable	EPA 624
5000	tert-Butyl methyl ether (MTBE)	µg/L	47.7	43.7	27.1 - 62.1	Acceptable	EPA 624
4450	Carbon disulfide	µg/L	< 1.0	0.00		Acceptable	EPA 624
0058	Carbon tetrachloride	µg/L	34.0	31.8	17.7 - 43.7	Acceptable	EPA 624
0064	Chlorobenzene	µg/L	80.6	84.7	61.1 - 106	Acceptable	EPA 624
0061	Chlorodibromomethane	µg/L	96.9	107	73.5 - 142	Acceptable	EPA 624
4485	Chloroethane	µg/L	< 1.0	0.00		Acceptable	EPA 624
4500	2-Chloroethylvinylether	µg/L	< 5.0	0.00		Acceptable	EPA 624
0055	Chloroform	µg/L	66.5	63.0	43.6 - 81.0	Acceptable	EPA 624
4960	Chloromethane	µg/L	< 1.0	0.00		Acceptable	EPA 624
4570	1,2-Dibromo-3-chloropropane (DBCP)	µg/L	< 2.0	0.00		Acceptable	EPA 624
4585	1,2-Dibromoethane (EDB)	µg/L	< 1.0	0.00		Acceptable	EPA 624
4595	Dibromomethane	µg/L	< 1.0	0.00		Acceptable	EPA 624
0094	1,2-Dichlorobenzene	µg/L	76.4	80.7	56.2 - 104	Acceptable	EPA 624
0096	1,3-Dichlorobenzene	µg/L	69.0	71.0	48.2 - 90.4	Acceptable	EPA 624
0095	1,4-Dichlorobenzene	µg/L	64.7	68.0	46.1 - 85.2	Acceptable	EPA 624
4625	Dichlorodifluoromethane (Freon 12)	µg/L	< 2.0	0.00		Acceptable	EPA 624
4630	1,1-Dichloroethane	µg/L	< 1.0	0.00		Acceptable	EPA 624
0054	1,2-Dichloroethane	µg/L	23.5	22.7	15.7 - 30.7	Acceptable	EPA 624
4640	1,1-Dichloroethylene	µg/L	< 1.0	0.00		Acceptable	EPA 624
4645	cis-1,2-Dichloroethylene	µg/L	28.1	26.0	17.9 - 34.8	Acceptable	EPA 624
4700	trans-1,2-Dichloroethylene	µg/L	< 1.0	0.00		Acceptable	EPA 624
4655	1,2-Dichloropropane	µg/L	< 1.0	0.00		Acceptable	EPA 624
4680	cis-1,3-Dichloropropylene	µg/L	35.5	45.0	31.5 - 58.5	Acceptable	EPA 624

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WP Volatiles (cat# 830) (Continued)							
4685	trans-1,3-Dichloropropylene	µg/L	< 1.0	0.00		Acceptable	EPA 624
0066	Ethylbenzene	µg/L	42.6	43.0	29.5 - 54.9	Acceptable	EPA 624
4835	Hexachlorobutadiene	µg/L	< 5.0	0.00		Acceptable	EPA 624
4860	2-Hexanone	µg/L	< 5.0	0.00		Acceptable	EPA 624
0063	Methylene chloride	µg/L	94.6	90.5	55.5 - 125	Acceptable	EPA 624
4995	4-Methyl-2-pentanone (MIBK)	µg/L	82.4	78.0	36.0 - 117	Acceptable	EPA 624
5005	Naphthalene	µg/L	26.1	32.8	11.1 - 42.6	Acceptable	EPA 624
5100	Styrene	µg/L	< 2.0	0.00		Acceptable	EPA 624
5105	1,1,1,2-Tetrachloroethane	µg/L	< 1.0	0.00		Acceptable	EPA 624
5110	1,1,2,2-Tetrachloroethane	µg/L	53.9	55.7	31.8 - 82.5	Acceptable	EPA 624
0059	Tetrachloroethylene	µg/L	44.0	45.9	25.3 - 60.1	Acceptable	EPA 624
0067	Toluene	µg/L	35.5	35.5	24.7 - 44.9	Acceptable	EPA 624
5155	1,2,4-Trichlorobenzene	µg/L	58.8	70.5	14.6 - 86.0	Acceptable	EPA 624
0056	1,1,1-Trichloroethane	µg/L	29.7	27.3	17.2 - 36.5	Acceptable	EPA 624
5165	1,1,2-Trichloroethane	µg/L	34.1	35.8	25.0 - 47.3	Acceptable	EPA 624
0057	Trichloroethylene	µg/L	72.1	69.9	44.4 - 91.1	Acceptable	EPA 624
5175	Trichlorofluoromethane	µg/L	< 2.0	0.00		Acceptable	EPA 624
5180	1,2,3-Trichloropropane (TCP)	µg/L	< 1.0	0.00		Acceptable	EPA 624
5225	Vinyl acetate	µg/L	< 5.0	0.00		Acceptable	EPA 624
5235	Vinyl chloride	µg/L	< 1.0	0.00		Acceptable	EPA 624
5260	Xylenes, total	µg/L	84.9	85.6	48.6 - 116	Acceptable	EPA 624

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 09/24/10
Study Dates: 07/20/10 - 09/03/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Volatiles (cat# 830)							
4315	Acetone	µg/L	< 5.0	0.00		Acceptable	EPA 8260B
4320	Acetonitrile	µg/L	< 2.0	0.00		Acceptable	EPA 8260B
4325	Acrolein	µg/L	< 50	0.00		Acceptable	EPA 8260B
4340	Acrylonitrile	µg/L	< 10	0.00		Acceptable	EPA 8260B
0065	Benzene	µg/L	20.3	20.0	13.6 - 26.4	Acceptable	EPA 8260B
0060	Bromodichloromethane	µg/L	19.7	20.1	13.8 - 27.0	Acceptable	EPA 8260B
0062	Bromoform	µg/L	25.3	30.2	18.6 - 41.2	Acceptable	EPA 8260B
4950	Bromomethane	µg/L	< 1.0	0.00		Acceptable	EPA 8260B
4410	2-Butanone (MEK)	µg/L	110	110	32.0 - 172	Acceptable	EPA 8260B
5000	tert-Butyl methyl ether (MTBE)	µg/L	47.7	43.7	27.1 - 62.1	Acceptable	EPA 8260B
4450	Carbon disulfide	µg/L	< 1.0	0.00		Acceptable	EPA 8260B
0058	Carbon tetrachloride	µg/L	34.0	31.8	17.7 - 43.7	Acceptable	EPA 8260B
0064	Chlorobenzene	µg/L	80.6	84.7	61.1 - 106	Acceptable	EPA 8260B
0061	Chlorodibromomethane	µg/L	96.9	107	73.5 - 142	Acceptable	EPA 8260B
4485	Chloroethane	µg/L	< 1.0	0.00		Acceptable	EPA 8260B
4500	2-Chloroethylvinylether	µg/L	< 5.0	0.00		Acceptable	EPA 8260B
0055	Chloroform	µg/L	66.5	63.0	43.6 - 81.0	Acceptable	EPA 8260B
4960	Chloromethane	µg/L	< 1.0	0.00		Acceptable	EPA 8260B
4570	1,2-Dibromo-3-chloropropane (DBCP)	µg/L	< 2.0	0.00		Acceptable	EPA 8260B
4585	1,2-Dibromoethane (EDB)	µg/L	< 1.0	0.00		Acceptable	EPA 8260B
4595	Dibromomethane	µg/L	< 1.0	0.00		Acceptable	EPA 8260B
0094	1,2-Dichlorobenzene	µg/L	76.4	80.7	56.2 - 104	Acceptable	EPA 8260B
0096	1,3-Dichlorobenzene	µg/L	69.0	71.0	48.2 - 90.4	Acceptable	EPA 8260B
0095	1,4-Dichlorobenzene	µg/L	64.7	68.0	46.1 - 85.2	Acceptable	EPA 8260B
4625	Dichlorodifluoromethane (Freon 12)	µg/L	< 2.0	0.00		Acceptable	EPA 8260B
4630	1,1-Dichloroethane	µg/L	< 1.0	0.00		Acceptable	EPA 8260B
0054	1,2-Dichloroethane	µg/L	23.5	22.7	15.7 - 30.7	Acceptable	EPA 8260B
4640	1,1-Dichloroethylene	µg/L	< 1.0	0.00		Acceptable	EPA 8260B
4645	cis-1,2-Dichloroethylene	µg/L	28.1	26.0	17.9 - 34.8	Acceptable	EPA 8260B
4700	trans-1,2-Dichloroethylene	µg/L	< 1.0	0.00		Acceptable	EPA 8260B
4655	1,2-Dichloropropane	µg/L	< 1.0	0.00		Acceptable	EPA 8260B
4680	cis-1,3-Dichloropropylene	µg/L	35.5	45.0	31.5 - 58.5	Acceptable	EPA 8260B

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

WP-186 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 09/24/10
Study Dates: 07/20/10 - 09/03/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Volatiles (cat# 830) (Continued)							
4685	trans-1,3-Dichloropropylene	µg/L	< 1.0	0.00		Acceptable	EPA 8260B
0066	Ethylbenzene	µg/L	42.6	43.0	29.5 - 54.9	Acceptable	EPA 8260B
4835	Hexachlorobutadiene	µg/L	< 5.0	0.00		Acceptable	EPA 8260B
4860	2-Hexanone	µg/L	< 5.0	0.00		Acceptable	EPA 8260B
0063	Methylene chloride	µg/L	94.6	90.5	55.5 - 125	Acceptable	EPA 8260B
4995	4-Methyl-2-pentanone (MIBK)	µg/L	82.4	78.0	36.0 - 117	Acceptable	EPA 8260B
5005	Naphthalene	µg/L	26.1	32.8	11.1 - 42.6	Acceptable	EPA 8260B
5100	Styrene	µg/L	< 2.0	0.00		Acceptable	EPA 8260B
5105	1,1,1,2-Tetrachloroethane	µg/L	< 1.0	0.00		Acceptable	EPA 8260B
5110	1,1,2,2-Tetrachloroethane	µg/L	53.9	55.7	31.8 - 82.5	Acceptable	EPA 8260B
0059	Tetrachloroethylene	µg/L	44.0	45.9	25.3 - 60.1	Acceptable	EPA 8260B
0067	Toluene	µg/L	35.5	35.5	24.7 - 44.9	Acceptable	EPA 8260B
5155	1,2,4-Trichlorobenzene	µg/L	58.8	70.5	14.6 - 86.0	Acceptable	EPA 8260B
0056	1,1,1-Trichloroethane	µg/L	29.7	27.3	17.2 - 36.5	Acceptable	EPA 8260B
5165	1,1,2-Trichloroethane	µg/L	34.1	35.8	25.0 - 47.3	Acceptable	EPA 8260B
0057	Trichloroethylene	µg/L	72.1	69.9	44.4 - 91.1	Acceptable	EPA 8260B
5175	Trichlorofluoromethane	µg/L	< 2.0	0.00		Acceptable	EPA 8260B
5180	1,2,3-Trichloropropane (TCP)	µg/L	< 1.0	0.00		Acceptable	EPA 8260B
5225	Vinyl acetate	µg/L	< 5.0	0.00		Acceptable	EPA 8260B
5235	Vinyl chloride	µg/L	< 1.0	0.00		Acceptable	EPA 8260B
5260	Xylenes, total	µg/L	84.9	85.6	48.6 - 116	Acceptable	EPA 8260B

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

WP-186 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 09/24/10
Study Dates: 07/20/10 - 09/03/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Volatiles (cat# 830)							
4315	Acetone	µg/L		0.00		Not Reported	
4320	Acetonitrile	µg/L		0.00		Not Reported	
4325	Acrolein	µg/L		0.00		Not Reported	
4340	Acrylonitrile	µg/L		0.00		Not Reported	
0065	Benzene	µg/L	20.2	20.0	13.6 - 26.4	Acceptable	EPA 602
0060	Bromodichloromethane	µg/L		20.1	13.8 - 27.0	Not Reported	
0062	Bromoform	µg/L		30.2	18.6 - 41.2	Not Reported	
4950	Bromomethane	µg/L		0.00		Not Reported	
4410	2-Butanone (MEK)	µg/L		110	32.0 - 172	Not Reported	
5000	tert-Butyl methyl ether (MTBE)	µg/L	42.3	43.7	27.1 - 62.1	Acceptable	EPA 602
4450	Carbon disulfide	µg/L		0.00		Not Reported	
0058	Carbon tetrachloride	µg/L		31.8	17.7 - 43.7	Not Reported	
0064	Chlorobenzene	µg/L	83.0	84.7	61.1 - 106	Acceptable	EPA 602
0061	Chlorodibromomethane	µg/L		107	73.5 - 142	Not Reported	
4485	Chloroethane	µg/L		0.00		Not Reported	
4500	2-Chloroethylvinylether	µg/L		0.00		Not Reported	
0055	Chloroform	µg/L		63.0	43.6 - 81.0	Not Reported	
4960	Chloromethane	µg/L		0.00		Not Reported	
4570	1,2-Dibromo-3-chloropropane (DBCP)	µg/L		0.00		Not Reported	
4585	1,2-Dibromoethane (EDB)	µg/L		0.00		Not Reported	
4595	Dibromomethane	µg/L		0.00		Not Reported	
0094	1,2-Dichlorobenzene	µg/L	79.3	80.7	56.2 - 104	Acceptable	EPA 602
0096	1,3-Dichlorobenzene	µg/L	69.0	71.0	48.2 - 90.4	Acceptable	EPA 602
0095	1,4-Dichlorobenzene	µg/L	63.8	68.0	46.1 - 85.2	Acceptable	EPA 602
4625	Dichlorodifluoromethane (Freon 12)	µg/L		0.00		Not Reported	
4630	1,1-Dichloroethane	µg/L		0.00		Not Reported	
0054	1,2-Dichloroethane	µg/L		22.7	15.7 - 30.7	Not Reported	
4640	1,1-Dichloroethylene	µg/L		0.00		Not Reported	
4645	cis-1,2-Dichloroethylene	µg/L		26.0	17.9 - 34.8	Not Reported	
4700	trans-1,2-Dichloroethylene	µg/L		0.00		Not Reported	
4655	1,2-Dichloropropane	µg/L		0.00		Not Reported	
4680	cis-1,3-Dichloropropylene	µg/L		45.0	31.5 - 58.5	Not Reported	

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

WP-186 Final Complete Report

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Director Corporate Quality Assurance
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2235 Route 130
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Study Dates: 07/20/10 - 09/03/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Volatiles (cat# 830) (Continued)							
4685	trans-1,3-Dichloropropylene	µg/L		0.00		Not Reported	
0066	Ethylbenzene	µg/L	42.3	43.0	29.5 - 54.9	Acceptable	EPA 602
4835	Hexachlorobutadiene	µg/L		0.00		Not Reported	
4860	2-Hexanone	µg/L		0.00		Not Reported	
0063	Methylene chloride	µg/L		90.5	55.5 - 125	Not Reported	
4995	4-Methyl-2-pentanone (MIBK)	µg/L		78.0	36.0 - 117	Not Reported	
5005	Naphthalene	µg/L		32.8	11.1 - 42.6	Not Reported	
5100	Styrene	µg/L		0.00		Not Reported	
5105	1,1,1,2-Tetrachloroethane	µg/L		0.00		Not Reported	
5110	1,1,2,2-Tetrachloroethane	µg/L		55.7	31.8 - 82.5	Not Reported	
0059	Tetrachloroethylene	µg/L		45.9	25.3 - 60.1	Not Reported	
0067	Toluene	µg/L	35.8	35.5	24.7 - 44.9	Acceptable	EPA 602
5155	1,2,4-Trichlorobenzene	µg/L		70.5	14.6 - 86.0	Not Reported	
0056	1,1,1-Trichloroethane	µg/L		27.3	17.2 - 36.5	Not Reported	
5165	1,1,2-Trichloroethane	µg/L		35.8	25.0 - 47.3	Not Reported	
0057	Trichloroethylene	µg/L		69.9	44.4 - 91.1	Not Reported	
5175	Trichlorofluoromethane	µg/L		0.00		Not Reported	
5180	1,2,3-Trichloropropane (TCP)	µg/L		0.00		Not Reported	
5225	Vinyl acetate	µg/L		0.00		Not Reported	
5235	Vinyl chloride	µg/L		0.00		Not Reported	
5260	Xylenes, total	µg/L	85.3	85.6	48.6 - 116	Acceptable	EPA 602

WP-186 Final Complete Report

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2235 Route 130
Dayton, NJ 08810
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ERA Customer Number: A064801
Report Issued: 09/24/10
Study Dates: 07/20/10 - 09/03/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Volatiles (cat# 830)							
4315	Acetone	µg/L		0.00		Not Reported	
4320	Acetonitrile	µg/L		0.00		Not Reported	
4325	Acrolein	µg/L		0.00		Not Reported	
4340	Acrylonitrile	µg/L		0.00		Not Reported	
0065	Benzene	µg/L	20.2	20.0	13.6 - 26.4	Acceptable	EPA 8021B
0060	Bromodichloromethane	µg/L		20.1	13.8 - 27.0	Not Reported	
0062	Bromoform	µg/L		30.2	18.6 - 41.2	Not Reported	
4950	Bromomethane	µg/L		0.00		Not Reported	
4410	2-Butanone (MEK)	µg/L		110	32.0 - 172	Not Reported	
5000	tert-Butyl methyl ether (MTBE)	µg/L	42.3	43.7	27.1 - 62.1	Acceptable	EPA 8021B
4450	Carbon disulfide	µg/L		0.00		Not Reported	
0058	Carbon tetrachloride	µg/L		31.8	17.7 - 43.7	Not Reported	
0064	Chlorobenzene	µg/L	83.0	84.7	61.1 - 106	Acceptable	EPA 8021B
0061	Chlorodibromomethane	µg/L		107	73.5 - 142	Not Reported	
4485	Chloroethane	µg/L		0.00		Not Reported	
4500	2-Chloroethylvinylether	µg/L		0.00		Not Reported	
0055	Chloroform	µg/L		63.0	43.6 - 81.0	Not Reported	
4960	Chloromethane	µg/L		0.00		Not Reported	
4570	1,2-Dibromo-3-chloropropane (DBCP)	µg/L		0.00		Not Reported	
4585	1,2-Dibromoethane (EDB)	µg/L		0.00		Not Reported	
4595	Dibromomethane	µg/L		0.00		Not Reported	
0094	1,2-Dichlorobenzene	µg/L	79.3	80.7	56.2 - 104	Acceptable	EPA 8021B
0096	1,3-Dichlorobenzene	µg/L	69.0	71.0	48.2 - 90.4	Acceptable	EPA 8021B
0095	1,4-Dichlorobenzene	µg/L	63.8	68.0	46.1 - 85.2	Acceptable	EPA 8021B
4625	Dichlorodifluoromethane (Freon 12)	µg/L		0.00		Not Reported	
4630	1,1-Dichloroethane	µg/L		0.00		Not Reported	
0054	1,2-Dichloroethane	µg/L		22.7	15.7 - 30.7	Not Reported	
4640	1,1-Dichloroethylene	µg/L		0.00		Not Reported	
4645	cis-1,2-Dichloroethylene	µg/L		26.0	17.9 - 34.8	Not Reported	
4700	trans-1,2-Dichloroethylene	µg/L		0.00		Not Reported	
4655	1,2-Dichloropropane	µg/L		0.00		Not Reported	
4680	cis-1,3-Dichloropropylene	µg/L		45.0	31.5 - 58.5	Not Reported	

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

WP-186 Final Complete Report

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Report Issued: 09/24/10
Study Dates: 07/20/10 - 09/03/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Volatiles (cat# 830) (Continued)							
4685	trans-1,3-Dichloropropylene	µg/L		0.00		Not Reported	
0066	Ethylbenzene	µg/L	42.3	43.0	29.5 - 54.9	Acceptable	EPA 8021B
4835	Hexachlorobutadiene	µg/L		0.00		Not Reported	
4860	2-Hexanone	µg/L		0.00		Not Reported	
0063	Methylene chloride	µg/L		90.5	55.5 - 125	Not Reported	
4995	4-Methyl-2-pentanone (MIBK)	µg/L		78.0	36.0 - 117	Not Reported	
5005	Naphthalene	µg/L		32.8	11.1 - 42.6	Not Reported	
5100	Styrene	µg/L		0.00		Not Reported	
5105	1,1,1,2-Tetrachloroethane	µg/L		0.00		Not Reported	
5110	1,1,2,2-Tetrachloroethane	µg/L		55.7	31.8 - 82.5	Not Reported	
0059	Tetrachloroethylene	µg/L		45.9	25.3 - 60.1	Not Reported	
0067	Toluene	µg/L	35.8	35.5	24.7 - 44.9	Acceptable	EPA 8021B
5155	1,2,4-Trichlorobenzene	µg/L		70.5	14.6 - 86.0	Not Reported	
0056	1,1,1-Trichloroethane	µg/L		27.3	17.2 - 36.5	Not Reported	
5165	1,1,2-Trichloroethane	µg/L		35.8	25.0 - 47.3	Not Reported	
0057	Trichloroethylene	µg/L		69.9	44.4 - 91.1	Not Reported	
5175	Trichlorofluoromethane	µg/L		0.00		Not Reported	
5180	1,2,3-Trichloropropane (TCP)	µg/L		0.00		Not Reported	
5225	Vinyl acetate	µg/L		0.00		Not Reported	
5235	Vinyl chloride	µg/L		0.00		Not Reported	
5260	Xylenes, total	µg/L	85.3	85.6	48.6 - 116	Acceptable	EPA 8021B
WP Chlorinated Acid Herbicides (cat# 829)							
8505	Acifluorfen	µg/L		2.82	0.500 - 4.20	Not Reported	
8530	Bentazon	µg/L		2.40	0.240 - 4.56	Not Reported	
8540	Chloramben	µg/L		4.39	0.439 - 6.44	Not Reported	
8545	2,4-D	µg/L	2.9	5.19	0.519 - 8.50	Acceptable	EPA 8151
8560	2,4-DB	µg/L	3.1	5.39	0.539 - 10.3	Acceptable	EPA 8151
8550	Dacthal diacid (DCPA)	µg/L		4.59	0.459 - 8.30	Not Reported	
8555	Dalapon	µg/L	2.9	3.43	0.343 - 5.73	Acceptable	EPA 8151
8595	Dicamba	µg/L	3.1	3.51	0.351 - 5.26	Acceptable	EPA 8151
8600	3,5-Dichlorobenzoic acid	µg/L		5.40	1.42 - 8.01	Not Reported	
8605	Dichlorprop	µg/L	5.6	8.27	1.32 - 12.3	Acceptable	EPA 8151
8620	Dinoseb	µg/L	3.3	9.30	0.930 - 14.4	Acceptable	EPA 8151
7775	MCPA	µg/L	< 50	0.00		Acceptable	EPA 8151
7780	MCPP	µg/L	< 50	0.00		Acceptable	EPA 8151
6500	4-Nitrophenol	µg/L		5.40	0.540 - 9.08	Not Reported	
6605	Pentachlorophenol	µg/L	6.0	7.67	0.767 - 12.3	Acceptable	EPA 8151
8645	Picloram	µg/L	1.2	2.18	0.218 - 3.90	Acceptable	EPA 8151
8655	2,4,5-T	µg/L	4.4	5.50	0.550 - 8.17	Acceptable	EPA 8151
8650	2,4,5-TP (Silvex)	µg/L	4.1	6.04	0.852 - 8.82	Acceptable	EPA 8151

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

WP-186 Final Complete Report

Phillip Worby
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2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 09/24/10
Study Dates: 07/20/10 - 09/03/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP PCBs in Water (cat# 832S)							
0040	Aroclor 1016	µg/L	< 0.50	0.00		Acceptable	EPA 608
8885	Aroclor 1221	µg/L	< 0.50	0.00		Acceptable	EPA 608
0042	Aroclor 1232	µg/L	< 0.50	0.00		Acceptable	EPA 608
0040	Aroclor 1242	µg/L	< 0.50	0.00		Acceptable	EPA 608
0044	Aroclor 1248	µg/L	< 0.50	0.00		Acceptable	EPA 608
0045	Aroclor 1254	µg/L	< 0.50	0.00		Acceptable	EPA 608
0046	Aroclor 1260	µg/L	2.4	2.62	1.25 - 3.47	Acceptable	EPA 608
WP PCBs in Water (cat# 832S)							
0040	Aroclor 1016	µg/L	< 0.50	0.00		Acceptable	EPA 8082
8885	Aroclor 1221	µg/L	< 0.50	0.00		Acceptable	EPA 8082
0042	Aroclor 1232	µg/L	< 0.50	0.00		Acceptable	EPA 8082
0040	Aroclor 1242	µg/L	< 0.50	0.00		Acceptable	EPA 8082
0044	Aroclor 1248	µg/L	< 0.50	0.00		Acceptable	EPA 8082
0045	Aroclor 1254	µg/L	< 0.50	0.00		Acceptable	EPA 8082
0046	Aroclor 1260	µg/L	2.4	2.62	1.25 - 3.47	Acceptable	EPA 8082
WP PCBs in Oil (cat# 835S)							
8880	Aroclor 1016	mg/kg	25.6	38.7	6.97 - 52.2	Acceptable	EPA 8082
8895	Aroclor 1242	mg/kg	< 2.5	0.00		Acceptable	EPA 8082
8905	Aroclor 1254	mg/kg	< 2.5	0.00		Acceptable	EPA 8082
8910	Aroclor 1260	mg/kg	< 2.5	0.00		Acceptable	EPA 8082

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

WP-186 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 09/24/10
Study Dates: 07/20/10 - 09/03/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Base/Neutrals (cat# 833)							
5500	Acenaphthene	µg/L	43.7	76.7	30.8 - 91.9	Acceptable	EPA 625
5505	Acenaphthylene	µg/L	< 1.0	0.00		Acceptable	EPA 625
5145	2-Amino-1-methylbenzene (o-toluidine)	µg/L	< 5.0	0.00		Acceptable	EPA 625
5545	Aniline	µg/L	< 2.0	0.00		Acceptable	EPA 625
5555	Anthracene	µg/L	< 1.0	0.00		Acceptable	EPA 625
5595	Benzidine	µg/L	< 20	0.00		Acceptable	EPA 625
5575	Benzo(a)anthracene	µg/L	< 1.0	0.00		Acceptable	EPA 625
5585	Benzo(b)fluoranthene	µg/L	23.7	28.7	9.38 - 40.2	Acceptable	EPA 625
5600	Benzo(k)fluoranthene	µg/L	54.9	60.8	14.6 - 89.3	Acceptable	EPA 625
5590	Benzo(g,h,i)perylene	µg/L	24.7	25.4	5.35 - 38.1	Acceptable	EPA 625
5580	Benzo(a)pyrene	µg/L	< 1.0	0.00		Acceptable	EPA 625
5630	Benzyl alcohol	µg/L	< 2.0	0.00		Acceptable	EPA 625
5660	4-Bromophenyl-phenylether	µg/L	22.2	28.6	10.8 - 40.2	Acceptable	EPA 625
5670	Butylbenzylphthalate	µg/L	93.6	123	23.7 - 175	Acceptable	EPA 625
5680	Carbazole	µg/L	< 2.0	0.00		Acceptable	EPA 625
5745	4-Chloroaniline	µg/L	< 2.0	0.00		Acceptable	EPA 625
5760	bis(2-Chloroethoxy)methane	µg/L	36.3	49.5	19.3 - 60.0	Acceptable	EPA 625
5765	bis(2-Chloroethyl)ether	µg/L	116	175	46.0 - 211	Acceptable	EPA 625
5780	bis(2-Chloroisopropyl)ether	µg/L	25.9	37.6	11.2 - 49.4	Acceptable	EPA 625
5790	1-Chloronaphthalene	µg/L	< 2.0	0.00		Acceptable	EPA 625
5795	2-Chloronaphthalene	µg/L	16.7	29.8	8.47 - 37.3	Acceptable	EPA 625
5825	4-Chlorophenyl-phenylether	µg/L	73.7	120	44.9 - 149	Acceptable	EPA 625
5855	Chrysene	µg/L	29.6	34.7	14.6 - 47.6	Acceptable	EPA 625
5895	Dibenz(a,h)anthracene	µg/L	< 1.0	0.00		Acceptable	EPA 625
5905	Dibenzofuran	µg/L	21.0	32.1	12.5 - 43.6	Acceptable	EPA 625
5925	Di-n-butylphthalate	µg/L	72.2	88.4	29.2 - 117	Acceptable	EPA 625
4610	1,2-Dichlorobenzene	µg/L	39.5	93.8	11.2 - 113	Acceptable	EPA 625
4615	1,3-Dichlorobenzene	µg/L	52.3	142	17.0 - 164	Acceptable	EPA 625
4620	1,4-Dichlorobenzene	µg/L	< 2.0	0.00		Acceptable	EPA 625
5945	3,3'-Dichlorobenzidine	µg/L	< 2.0	0.00		Acceptable	EPA 625
6070	Diethylphthalate	µg/L	88.7	122	22.6 - 167	Acceptable	EPA 625
6135	Dimethylphthalate	µg/L	97.8	132	13.2 - 190	Acceptable	EPA 625

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Base/Neutrals (cat# 833) (Continued)							
6185	2,4-Dinitrotoluene	µg/L	< 2.0	0.00		Acceptable	EPA 625
6190	2,6-Dinitrotoluene	µg/L	< 2.0	0.00		Acceptable	EPA 625
6200	Di-n-octylphthalate	µg/L	112	141	27.6 - 207	Acceptable	EPA 625
6065	bis(2-Ethylhexyl)phthalate	µg/L	64.3	81.4	24.3 - 113	Acceptable	EPA 625
6265	Fluoranthene	µg/L	45.5	57.4	26.2 - 71.9	Acceptable	EPA 625
6270	Fluorene	µg/L	44.1	66.2	27.4 - 81.3	Acceptable	EPA 625
6275	Hexachlorobenzene	µg/L	< 1.0	0.00		Acceptable	EPA 625
4835	Hexachlorobutadiene	µg/L	< 1.0	0.00		Acceptable	EPA 625
6285	Hexachlorocyclopentadiene	µg/L	94.3	179	17.9 - 230	Acceptable	EPA 625
4840	Hexachloroethane	µg/L	42.7	116	12.2 - 136	Acceptable	EPA 625
6315	Indeno(1,2,3-cd)pyrene	µg/L	< 1.0	0.00		Acceptable	EPA 625
6320	Isophorone	µg/L	65.2	105	41.1 - 135	Acceptable	EPA 625
6385	2-Methylnaphthalene	µg/L	27.6	53.4	8.89 - 67.8	Acceptable	EPA 625
5005	Naphthalene	µg/L	52.6	114	30.1 - 135	Acceptable	EPA 625
6460	2-Nitroaniline	µg/L	< 5.0	0.00		Acceptable	EPA 625
6465	3-Nitroaniline	µg/L	< 5.0	0.00		Acceptable	EPA 625
6470	4-Nitroaniline	µg/L	< 5.0	0.00		Acceptable	EPA 625
5015	Nitrobenzene	µg/L	37.6	56.0	18.1 - 69.8	Acceptable	EPA 625
6525	N-Nitrosodiethylamine	µg/L	< 5.0	0.00		Acceptable	EPA 625
6530	N-Nitrosodimethylamine	µg/L	< 2.0	0.00		Acceptable	EPA 625
6535	N-Nitrosodiphenylamine	µg/L	< 5.0	0.00		Acceptable	EPA 625
6545	N-Nitroso-di-n-propylamine	µg/L	65.9	89.2	25.8 - 115	Acceptable	EPA 625
6590	Pentachlorobenzene	µg/L	< 5.0	0.00		Acceptable	EPA 625
6615	Phenanthrene	µg/L	< 1.0	0.00		Acceptable	EPA 625
6665	Pyrene	µg/L	34.4	41.1	13.3 - 59.4	Acceptable	EPA 625
5095	Pyridine	µg/L	< 2.0	0.00		Acceptable	EPA 625
6715	1,2,4,5-Tetrachlorobenzene	µg/L	< 5.0	0.00		Acceptable	EPA 625
5155	1,2,4-Trichlorobenzene	µg/L	< 1.0	0.00		Acceptable	EPA 625

WP-186 Final Complete Report

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Dayton, NJ 08810
732-329-0200

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Study Dates: 07/20/10 - 09/03/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Base/Neutrals (cat# 833)							
5500	Acenaphthene	µg/L	43.7	76.7	30.8 - 91.9	Acceptable	EPA 8270C
5505	Acenaphthylene	µg/L	< 1.0	0.00		Acceptable	EPA 8270C
5145	2-Amino-1-methylbenzene (o-toluidine)	µg/L	< 5.0	0.00		Acceptable	EPA 8270C
5545	Aniline	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
5555	Anthracene	µg/L	< 1.0	0.00		Acceptable	EPA 8270C
5595	Benzidine	µg/L	< 20	0.00		Acceptable	EPA 8270C
5575	Benzo(a)anthracene	µg/L	< 1.0	0.00		Acceptable	EPA 8270C
5585	Benzo(b)fluoranthene	µg/L	23.7	28.7	9.38 - 40.2	Acceptable	EPA 8270C
5600	Benzo(k)fluoranthene	µg/L	54.9	60.8	14.6 - 89.3	Acceptable	EPA 8270C
5590	Benzo(g,h,i)perylene	µg/L	24.7	25.4	5.35 - 38.1	Acceptable	EPA 8270C
5580	Benzo(a)pyrene	µg/L	< 1.0	0.00		Acceptable	EPA 8270C
5630	Benzyl alcohol	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
5660	4-Bromophenyl-phenylether	µg/L	22.2	28.6	10.8 - 40.2	Acceptable	EPA 8270C
5670	Butylbenzylphthalate	µg/L	93.6	123	23.7 - 175	Acceptable	EPA 8270C
5680	Carbazole	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
5745	4-Chloroaniline	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
5760	bis(2-Chloroethoxy)methane	µg/L	36.3	49.5	19.3 - 60.0	Acceptable	EPA 8270C
5765	bis(2-Chloroethyl)ether	µg/L	116	175	46.0 - 211	Acceptable	EPA 8270C
5780	bis(2-Chloroisopropyl)ether	µg/L	25.9	37.6	11.2 - 49.4	Acceptable	EPA 8270C
5790	1-Chloronaphthalene	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
5795	2-Chloronaphthalene	µg/L	16.7	29.8	8.47 - 37.3	Acceptable	EPA 8270C
5825	4-Chlorophenyl-phenylether	µg/L	73.7	120	44.9 - 149	Acceptable	EPA 8270C
5855	Chrysene	µg/L	29.6	34.7	14.6 - 47.6	Acceptable	EPA 8270C
5895	Dibenz(a,h)anthracene	µg/L	< 1.0	0.00		Acceptable	EPA 8270C
5905	Dibenzofuran	µg/L	21.0	32.1	12.5 - 43.6	Acceptable	EPA 8270C
5925	Di-n-butylphthalate	µg/L	72.2	88.4	29.2 - 117	Acceptable	EPA 8270C
4610	1,2-Dichlorobenzene	µg/L	39.5	93.8	11.2 - 113	Acceptable	EPA 8270C
4615	1,3-Dichlorobenzene	µg/L	52.3	142	17.0 - 164	Acceptable	EPA 8270C
4620	1,4-Dichlorobenzene	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
5945	3,3'-Dichlorobenzidine	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
6070	Diethylphthalate	µg/L	88.7	122	22.6 - 167	Acceptable	EPA 8270C
6135	Dimethylphthalate	µg/L	97.8	132	13.2 - 190	Acceptable	EPA 8270C

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
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732-329-0200

EPA ID: NJ00141
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Study Dates: 07/20/10 - 09/03/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Base/Neutrals (cat# 833) (Continued)							
6185	2,4-Dinitrotoluene	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
6190	2,6-Dinitrotoluene	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
6200	Di-n-octylphthalate	µg/L	112	141	27.6 - 207	Acceptable	EPA 8270C
6065	bis(2-Ethylhexyl)phthalate	µg/L	64.3	81.4	24.3 - 113	Acceptable	EPA 8270C
6265	Fluoranthene	µg/L	45.5	57.4	26.2 - 71.9	Acceptable	EPA 8270C
6270	Fluorene	µg/L	44.1	66.2	27.4 - 81.3	Acceptable	EPA 8270C
6275	Hexachlorobenzene	µg/L	< 1.0	0.00		Acceptable	EPA 8270C
4835	Hexachlorobutadiene	µg/L	< 1.0	0.00		Acceptable	EPA 8270C
6285	Hexachlorocyclopentadiene	µg/L	94.3	179	17.9 - 230	Acceptable	EPA 8270C
4840	Hexachloroethane	µg/L	42.7	116	12.2 - 136	Acceptable	EPA 8270C
6315	Indeno(1,2,3-cd)pyrene	µg/L	< 1.0	0.00		Acceptable	EPA 8270C
6320	Isophorone	µg/L	65.2	105	41.1 - 135	Acceptable	EPA 8270C
6385	2-Methylnaphthalene	µg/L	27.6	53.4	8.89 - 67.8	Acceptable	EPA 8270C
5005	Naphthalene	µg/L	52.6	114	30.1 - 135	Acceptable	EPA 8270C
6460	2-Nitroaniline	µg/L	< 5.0	0.00		Acceptable	EPA 8270C
6465	3-Nitroaniline	µg/L	< 5.0	0.00		Acceptable	EPA 8270C
6470	4-Nitroaniline	µg/L	< 5.0	0.00		Acceptable	EPA 8270C
5015	Nitrobenzene	µg/L	37.6	56.0	18.1 - 69.8	Acceptable	EPA 8270C
6525	N-Nitrosodiethylamine	µg/L	< 5.0	0.00		Acceptable	EPA 8270C
6530	N-Nitrosodimethylamine	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
6535	N-Nitrosodiphenylamine	µg/L	< 5.0	0.00		Acceptable	EPA 8270C
6545	N-Nitroso-di-n-propylamine	µg/L	65.9	89.2	25.8 - 115	Acceptable	EPA 8270C
6590	Pentachlorobenzene	µg/L	< 5.0	0.00		Acceptable	EPA 8270C
6615	Phenanthrene	µg/L	< 1.0	0.00		Acceptable	EPA 8270C
6665	Pyrene	µg/L	34.4	41.1	13.3 - 59.4	Acceptable	EPA 8270C
5095	Pyridine	µg/L	< 2.0	0.00		Acceptable	EPA 8270C
6715	1,2,4,5-Tetrachlorobenzene	µg/L	< 5.0	0.00		Acceptable	EPA 8270C
5155	1,2,4-Trichlorobenzene	µg/L	< 1.0	0.00		Acceptable	EPA 8270C

WP-186 Final Complete Report

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Acids (cat# 834)							
5610	Benzoic acid	µg/L	< 20	0.00		Acceptable	EPA 625
5700	4-Chloro-3-methylphenol	µg/L	148	176	69.6 - 226	Acceptable	EPA 625
5800	2-Chlorophenol	µg/L	41.2	55.5	17.5 - 70.6	Acceptable	EPA 625
6000	2,4-Dichlorophenol	µg/L	83.4	99.7	31.8 - 124	Acceptable	EPA 625
6005	2,6-Dichlorophenol	µg/L	89.5	99.6	33.4 - 125	Acceptable	EPA 625
6130	2,4-Dimethylphenol	µg/L	108	133	29.1 - 174	Acceptable	EPA 625
6360	4,6-Dinitro-2-methylphenol	µg/L	113	136	47.0 - 193	Acceptable	EPA 625
6175	2,4-Dinitrophenol	µg/L	114	113	11.3 - 160	Acceptable	EPA 625
6400	2-Methylphenol	µg/L	40.7	57.0	10.8 - 72.0	Acceptable	EPA 625
6410	4-Methylphenol	µg/L	97.3	164	16.4 - 210	Acceptable	EPA 625
6490	2-Nitrophenol	µg/L	136	161	36.3 - 212	Acceptable	EPA 625
6500	4-Nitrophenol	µg/L	59.7	152	15.2 - 204	Acceptable	EPA 625
6605	Pentachlorophenol	µg/L	197	196	55.6 - 271	Acceptable	EPA 625
6625	Phenol	µg/L	48.3	159	15.9 - 213	Acceptable	EPA 625
6735	2,3,4,6-Tetrachlorophenol	µg/L	38.7	38.3	8.62 - 51.6	Acceptable	EPA 625
6835	2,4,5-Trichlorophenol	µg/L	62.3	69.0	25.8 - 90.7	Acceptable	EPA 625
6840	2,4,6-Trichlorophenol	µg/L	151	174	55.6 - 216	Acceptable	EPA 625
WP Acids (cat# 834)							
5610	Benzoic acid	µg/L	< 20	0.00		Acceptable	EPA 8270C
5700	4-Chloro-3-methylphenol	µg/L	148	176	69.6 - 226	Acceptable	EPA 8270C
5800	2-Chlorophenol	µg/L	41.2	55.5	17.5 - 70.6	Acceptable	EPA 8270C
6000	2,4-Dichlorophenol	µg/L	83.4	99.7	31.8 - 124	Acceptable	EPA 8270C
6005	2,6-Dichlorophenol	µg/L	89.5	99.6	33.4 - 125	Acceptable	EPA 8270C
6130	2,4-Dimethylphenol	µg/L	108	133	29.1 - 174	Acceptable	EPA 8270C
6360	4,6-Dinitro-2-methylphenol	µg/L	113	136	47.0 - 193	Acceptable	EPA 8270C
6175	2,4-Dinitrophenol	µg/L	114	113	11.3 - 160	Acceptable	EPA 8270C
6400	2-Methylphenol	µg/L	40.7	57.0	10.8 - 72.0	Acceptable	EPA 8270C
6410	4-Methylphenol	µg/L	97.3	164	16.4 - 210	Acceptable	EPA 8270C
6490	2-Nitrophenol	µg/L	136	161	36.3 - 212	Acceptable	EPA 8270C
6500	4-Nitrophenol	µg/L	59.7	152	15.2 - 204	Acceptable	EPA 8270C
6605	Pentachlorophenol	µg/L	197	196	55.6 - 271	Acceptable	EPA 8270C
6625	Phenol	µg/L	48.3	159	15.9 - 213	Acceptable	EPA 8270C
6735	2,3,4,6-Tetrachlorophenol	µg/L	38.7	38.3	8.62 - 51.6	Acceptable	EPA 8270C
6835	2,4,5-Trichlorophenol	µg/L	62.3	69.0	25.8 - 90.7	Acceptable	EPA 8270C
6840	2,4,6-Trichlorophenol	µg/L	151	174	55.6 - 216	Acceptable	EPA 8270C

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

WP-186 Final Complete Report

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EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 09/24/10
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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Low-Level PAHs (cat# 836)							
5500	Acenaphthene	µg/L	5.33	8.18	4.41 - 9.49	Acceptable	EPA 8310 UV
5505	Acenaphthylene	µg/L	1.72	2.52	1.05 - 3.14	Acceptable	EPA 8310 UV
5555	Anthracene	µg/L	0.607	0.762	0.214 - 1.07	Acceptable	EPA 8310 UV
5575	Benzo(a)anthracene	µg/L	0.813	0.975	0.578 - 1.14	Acceptable	EPA 8310 UV
5585	Benzo(b)fluoranthene	µg/L	0.850	0.975	0.431 - 1.24	Acceptable	EPA 8310 UV
5600	Benzo(k)fluoranthene	µg/L	1.34	1.58	0.889 - 1.90	Acceptable	EPA 8310 UV
5590	Benzo(g,h,i)perylene	µg/L	0.820	0.893	0.318 - 1.18	Acceptable	EPA 8310 UV
5580	Benzo(a)pyrene	µg/L	0.581	0.664	0.236 - 0.977	Acceptable	EPA 8310 UV
5855	Chrysene	µg/L	0.599	0.669	0.374 - 0.877	Acceptable	EPA 8310 UV
5895	Dibenz(a,h)anthracene	µg/L	1.44	1.94	0.642 - 2.56	Acceptable	EPA 8310 UV
6265	Fluoranthene	µg/L	1.26	1.59	0.941 - 1.91	Acceptable	EPA 8310 UV
6270	Fluorene	µg/L	1.85	2.40	0.900 - 3.05	Acceptable	EPA 8310 UV
6315	Indeno(1,2,3-cd)pyrene	µg/L	1.46	1.52	0.695 - 1.88	Acceptable	EPA 8310 UV
5005	Naphthalene	µg/L	4.86	7.52	2.90 - 8.27	Acceptable	EPA 8310 UV
6615	Phenanthrene	µg/L	1.09	1.38	0.702 - 1.66	Acceptable	EPA 8310 UV
6665	Pyrene	µg/L	0.666	0.849	0.484 - 1.05	Acceptable	EPA 8310 UV
WP Organochlorine Pesticides (cat# 831)							
0047	Aldrin	µg/L	1.6	2.06	0.601 - 2.87	Acceptable	EPA 608
7110	alpha-BHC	µg/L	15.2	14.3	6.56 - 19.2	Acceptable	EPA 608
7115	beta-BHC	µg/L	10.7	10.7	4.47 - 14.4	Acceptable	EPA 608
7105	delta-BHC	µg/L	2.2	2.25	0.678 - 3.17	Acceptable	EPA 608
7120	gamma-BHC(Lindane)	µg/L	3.5	3.33	1.31 - 4.70	Acceptable	EPA 608
7240	alpha-Chlordane	µg/L	1.9	1.89	0.838 - 2.69	Acceptable	EPA 608
7245	gamma-Chlordane	µg/L	6.1	6.43	2.64 - 8.73	Acceptable	EPA 608
0049	4,4'-DDD	µg/L	9.6	9.21	3.36 - 13.1	Acceptable	EPA 608
0050	4,4'-DDE	µg/L	9.9	9.76	4.36 - 12.5	Acceptable	EPA 608
0051	4,4'-DDT	µg/L	3.3	3.40	1.27 - 4.92	Acceptable	EPA 608
0048	Dieldrin	µg/L	3.0	2.89	1.37 - 4.00	Acceptable	EPA 608
7540	Endrin	µg/L	5.3	5.72	2.10 - 8.59	Acceptable	EPA 608
7530	Endrin aldehyde	µg/L	9.7	9.30	2.70 - 14.0	Acceptable	EPA 608
7535	Endrin ketone	µg/L	9.3	9.37	5.15 - 13.6	Acceptable	EPA 608
7510	Endosulfan I	µg/L	7.3	11.3	3.36 - 16.4	Acceptable	EPA 608
7515	Endosulfan II	µg/L	7.3	9.39	2.99 - 12.6	Acceptable	EPA 608
7520	Endosulfan sulfate	µg/L	9.7	9.45	3.56 - 13.8	Acceptable	EPA 608
0052	Heptachlor	µg/L	2.6	3.39	1.10 - 4.68	Acceptable	EPA 608
0078	Heptachlor epoxide (beta)	µg/L	4.6	4.41	2.16 - 6.20	Acceptable	EPA 608
7810	Methoxychlor	µg/L	5.8	5.80	1.48 - 9.31	Acceptable	EPA 608

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

WP-186 Final Complete Report

Phillip Worby
Director Corporate Quality Assurance
Accutest Mid Atlantic
2235 Route 130
Dayton, NJ 08810
732-329-0200

EPA ID: NJ00141
ERA Customer Number: A064801
Report Issued: 09/24/10
Study Dates: 07/20/10 - 09/03/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Organochlorine Pesticides (cat# 831)							
0047	Aldrin	µg/L	1.6	2.06	0.601 - 2.87	Acceptable	EPA 8081A
7110	alpha-BHC	µg/L	15.2	14.3	6.56 - 19.2	Acceptable	EPA 8081A
7115	beta-BHC	µg/L	10.7	10.7	4.47 - 14.4	Acceptable	EPA 8081A
7105	delta-BHC	µg/L	2.2	2.25	0.678 - 3.17	Acceptable	EPA 8081A
7120	gamma-BHC(Lindane)	µg/L	3.5	3.33	1.31 - 4.70	Acceptable	EPA 8081A
7240	alpha-Chlordane	µg/L	1.9	1.89	0.838 - 2.69	Acceptable	EPA 8081A
7245	gamma-Chlordane	µg/L	6.1	6.43	2.64 - 8.73	Acceptable	EPA 8081A
0049	4,4'-DDD	µg/L	9.6	9.21	3.36 - 13.1	Acceptable	EPA 8081A
0050	4,4'-DDE	µg/L	9.9	9.76	4.36 - 12.5	Acceptable	EPA 8081A
0051	4,4'-DDT	µg/L	3.3	3.40	1.27 - 4.92	Acceptable	EPA 8081A
0048	Dieldrin	µg/L	3.0	2.89	1.37 - 4.00	Acceptable	EPA 8081A
7540	Endrin	µg/L	5.3	5.72	2.10 - 8.59	Acceptable	EPA 8081A
7530	Endrin aldehyde	µg/L	9.7	9.30	2.70 - 14.0	Acceptable	EPA 8081A
7535	Endrin ketone	µg/L	9.3	9.37	5.15 - 13.6	Acceptable	EPA 8081A
7510	Endosulfan I	µg/L	7.3	11.3	3.36 - 16.4	Acceptable	EPA 8081A
7515	Endosulfan II	µg/L	7.3	9.39	2.99 - 12.6	Acceptable	EPA 8081A
7520	Endosulfan sulfate	µg/L	9.7	9.45	3.56 - 13.8	Acceptable	EPA 8081A
0052	Heptachlor	µg/L	2.6	3.39	1.10 - 4.68	Acceptable	EPA 8081A
0078	Heptachlor epoxide (beta)	µg/L	4.6	4.41	2.16 - 6.20	Acceptable	EPA 8081A
7810	Methoxychlor	µg/L	5.8	5.80	1.48 - 9.31	Acceptable	EPA 8081A
WP Chlordane (cat# 837)							
0053	Chlordane, technical	µg/L	3.0	3.43	1.28 - 5.01	Acceptable	EPA 608
WP Chlordane (cat# 837)							
0053	Chlordane, technical	µg/L	3.0	3.43	1.28 - 5.01	Acceptable	EPA 8081A
WP Toxaphene (cat# 838)							
8250	Toxaphene	µg/L	31.4	29.9	2.99 - 54.1	Acceptable	EPA 608
WP Toxaphene (cat# 838)							
8250	Toxaphene	µg/L	31.4	29.9	2.99 - 54.1	Acceptable	EPA 8081A
WP Total Organic Halides (TOX) (cat# 895)							
2045	Total Organic Halides (TOX)	µg/L	338	356	243 - 459	Acceptable	EPA 9020B

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

ERA

A Waters Company

Amy Rice
Alpha Analytical
8 Walkup Drive
Westborough, MA 01581

WP-189 Final Report

WatR™ Pollution Proficiency Testing

WatR™ Pollution Study

Open Date: 10/08/10

Close Date: 11/22/10

Report Issued Date: 12/10/10

ERA
A Waters Company

December 10, 2010

Amy Rice
Alpha Analytical
8 Walkup Drive
Westborough, MA 01581

Enclosed is your final report for ERA's WP-189 WatR™Pollution Proficiency Testing (PT) study. Your final report includes an evaluation of all results submitted by your laboratory to ERA.

Data Evaluation Protocols: All analytes in ERA's WP-189 WatR™Pollution Proficiency Testing study have been evaluated using the following tiered approach. If the analyte is listed in the most current National Environmental Laboratory Accreditation Conference (NELAC) PT Field of Testing tables, the evaluation was completed by comparing the reported result to the acceptance limits generated using the criteria contained in the NELAC FoPT tables. If the analyte is not included in the NELAC FoPT tables, the reported result has been evaluated using the procedures outlined in ERA's Standard Operating Procedure for the Generation of Performance Acceptance Limits (SOP 0260).

Corrective Action Help: As part of your accreditation(s), you may be required to identify the root cause of any "Not Acceptable" results, implement the necessary corrective actions, and then satisfy your PT requirements by participating in a Supplemental (QuiK™ Response) or future ERA PT study. ERA's technical staff is available to help your laboratory resolve any technical issues that may be impairing your PT performance and possibly affecting your routine data quality. Our laboratory and technical staff have well over three hundred years of collective experience in performing the full range of environmental analyses. As part of our technical support, ERA offers QC samples that can be helpful in helping you work through your technical issues.

Thank you for your participation in ERA's WP-189 WatR™Pollution Proficiency Testing study. If you have any questions, please contact the proficiency testing department, or myself, at 1-800-372-0122.

Sincerely,

Jay R. McBurney
Quality Program Manager

attachments
jrm

ERA
A Waters Company

Report Recipient	Contact/Phone Number	Reporting Type
Louisiana	Paul Bergeron / 225-219-1244	All Analytes

ERA
A Waters Company

WP-189 Definitions & Study Discussion

Study Dates: 10/08/10 - 11/22/10 **Report Issued: 12/10/10**

WP Study Definitions

The Reported Value is the value that the laboratory reported to ERA.

The ERA Assigned Values are compliant with the most current USEPA/NELAC FoPT tables. A parameter not added to the standard is given an Assigned Value of "0" per the guidelines contained in the USEPA's Criteria Document and NELAC standards.

The Acceptance Limits are established per the criteria contained in the most current USEPA/NELAC FoPT tables, or ERA's SOP for the Generation of Performance Acceptance Limits™ as applicable.

The Performance Evaluation:

Acceptable	= Reported Value falls within the Acceptance Limits.
Not Acceptable	= Reported Value falls outside the Acceptance Limits.
No Evaluation	= Reported Value cannot be evaluated.
Not Reported	= No Value reported.

The Method Description is the method the laboratory reported to ERA.

WP Study Discussion

ERA's WP-189 WatR™Pollution Proficiency Testing study has been reviewed by ERA senior management and certified compliant with the requirements of the USEPA's National Standards for Water Proficiency Testing Studies Criteria Document (December 1998), and the criteria contained in the most current NELAC FoPT tables.

ERA's WP-189 WatR™Pollution study standards were examined for any anomalies. A full review of all homogeneity, stability and accuracy verification data was completed. All analytical verification data for all analytes met the acceptance criteria contained in the USEPA's National Criteria Document for Water Proficiency Testing Studies, December 1998, and the criteria contained in the most current NELAC FoPT tables.

The data submitted by participating laboratories was also examined for study anomalies. There were no anomalies observed during the statistical review of the data.

If you have any questions or concerns regarding your assessment in ERA's WatR™Pollution Proficiency Testing program, please contact Jay McBurney, Quality Program Manager, or the proficiency testing department, at 1-800-372-0122.

ACCREDITED
Lab Code 1918/05

ERA
A Waters Company

Study: **WP-189**

ERA Customer Number: **W574801**

Laboratory Name: **Alpha Analytical**

Inorganic Results

ERA
A Waters Company

WP-189 Final Complete Report

Amy Rice
Quality Systems Specialist
Alpha Analytical
8 Walkup Drive
Westborough, MA 01581
508-439-5138

EPA ID: MA00030
ERA Customer Number: W574801
Report Issued: 12/10/10
Study Dates: 10/08/10 - 11/22/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Minerals (cat# 581)							
0027	Alkalinity as CaCO3	mg/L	110	116	103 - 128	Acceptable	SM2320B
0028	Chloride	mg/L		59.0	50.2 - 68.2	Not Reported	
0020	Conductivity at 25°C	µmhos/cm	490	490	441 - 539	Acceptable	EPA 9050A
0029	Fluoride	mg/L		2.02	1.65 - 2.40	Not Reported	
0026	Potassium	mg/L	32.6	31.5	26.0 - 37.5	Acceptable	EPA 6020A
0025	Sodium	mg/L	91.6	89.3	75.8 - 102	Acceptable	EPA 6020A
0030	Sulfate	mg/L		33.6	27.0 - 39.3	Not Reported	
0021	Total Dissolved Solids at 180°C	mg/L		398	303 - 493	Not Reported	
1950	Total Solids at 105°C	mg/L		425	379 - 468	Not Reported	
WP Hardness (cat# 580)							
0072	Non-Filterable Residue (TSS)	mg/L	58.6	52.5	41.0 - 59.9	Acceptable	SM2540D
0023	Calcium	mg/L	63.3	62.1	55.5 - 70.4	Acceptable	EPA 6020A
0024	Magnesium	mg/L	37.5	37.2	31.9 - 42.8	Acceptable	EPA 6020A
1550	Calcium Hardness as CaCO3	mg/L		155	138 - 176	Not Reported	
0022	Total Hardness as CaCO3	mg/L	312	308	270 - 352	Acceptable	EPA 6020A
WP pH (cat# 577)							
0019	pH	S.U.	6.11	6.11	5.91 - 6.31	Acceptable	EPA 9040B
WP pH (cat# 577)							
0019	pH	S.U.	6.11	6.11	5.91 - 6.31	Acceptable	SM4500H+ B

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

R2-0001046

ERA
A Waters Company

WP-189 Final Complete Report

Amy Rice
Quality Systems Specialist
Alpha Analytical
8 Walkup Drive
Westborough, MA 01581
508-439-5138

EPA ID: MA00030
ERA Customer Number: W574801
Report Issued: 12/10/10
Study Dates: 10/08/10 - 11/22/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Trace Metals (cat# 586)							
0001	Aluminum	µg/L	2190	2180	1790 - 2540	Acceptable	EPA 6020A
0016	Antimony	µg/L	813	799	566 - 959	Acceptable	EPA 6020A
0002	Arsenic	µg/L	122	125	101 - 149	Acceptable	EPA 6020A
1015	Barium	µg/L	1070	1020	885 - 1150	Acceptable	EPA 6020A
0003	Beryllium	µg/L	510	546	464 - 617	Acceptable	EPA 6020A
1025	Boron	µg/L	1030	985	813 - 1150	Acceptable	EPA 6020A
0004	Cadmium	µg/L	342	346	295 - 393	Acceptable	EPA 6020A
0006	Chromium	µg/L	1030	945	825 - 1070	Acceptable	EPA 6020A
0005	Cobalt	µg/L	979	908	799 - 1020	Acceptable	EPA 6020A
0007	Copper	µg/L	375	342	308 - 377	Acceptable	EPA 6020A
0008	Iron	µg/L	432	402	352 - 458	Acceptable	EPA 6020A
0012	Lead	µg/L	351	349	301 - 395	Acceptable	EPA 6020A
0010	Manganese	µg/L	1040	918	824 - 1020	Not Acceptable	EPA 6020A
0074	Molybdenum	µg/L	226	216	180 - 250	Acceptable	EPA 6020A
0011	Nickel	µg/L	741	678	610 - 759	Acceptable	EPA 6020A
0013	Selenium	µg/L	112	120	91.6 - 140	Acceptable	EPA 6020A
0017	Silver	µg/L	509	472	405 - 541	Acceptable	EPA 6020A
0075	Strontium	µg/L	207	195	169 - 222	Acceptable	EPA 6020A
0018	Thallium	µg/L	364	352	274 - 430	Acceptable	EPA 6020A
0014	Vanadium	µg/L	590	547	479 - 612	Acceptable	EPA 6020A
0015	Zinc	µg/L	399	392	335 - 454	Acceptable	EPA 6020A
WP Mercury (cat# 574)							
0009	Mercury	µg/L	15.3	14.9	9.17 - 20.2	Acceptable	EPA 7470A
WP Mercury (cat# 574)							
0009	Mercury	µg/L	14.4	14.9	9.17 - 20.2	Acceptable	EPA 7474
WP Tin & Titanium (cat# 573)							
1175	Tin	µg/L	4800	4520	3560 - 5510	Acceptable	EPA 6020A
0076	Titanium	µg/L	107	110	93.7 - 125	Acceptable	EPA 6020A

ACCREDITED Lab Code: 1539-01

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

ERA
A Waters Company

Study: **WP-189**

ERA Customer Number: **W574801**

Laboratory Name: **Alpha Analytical**

Organic Results

ACCREDITED
Lab Code: 1918-01

ERA
A Waters Company

WP-189 Final Complete Report

Amy Rice
Quality Systems Specialist
Alpha Analytical
8 Walkup Drive
Westborough, MA 01581
508-439-5138

EPA ID: MA00030
ERA Customer Number: W574801
Report Issued: 12/10/10
Study Dates: 10/08/10 - 11/22/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Volatiles (cat# 830)							
4315	Acetone	µg/L	104	83.8	16.2 - 136	Acceptable	EPA 8260B
4320	Acetonitrile	µg/L		0.00		Not Reported	
4325	Acrolein	µg/L	< 5.00	0.00		Acceptable	EPA 8260B
4340	Acrylonitrile	µg/L	< 5.00	0.00		Acceptable	EPA 8260B
0065	Benzene	µg/L	32.4	25.6	17.8 - 33.4	Acceptable	EPA 8260B
0060	Bromodichloromethane	µg/L	102	77.8	55.2 - 105	Acceptable	EPA 8260B
0062	Bromoform	µg/L	70.9	56.0	35.8 - 77.1	Acceptable	EPA 8260B
4950	Bromomethane	µg/L	20.8	21.6	8.64 - 34.6	Acceptable	EPA 8260B
4410	2-Butanone (MEK)	µg/L	< 5.00	0.00		Acceptable	EPA 8260B
5000	tert-Butyl methyl ether (MTBE)	µg/L	26.9	21.5	12.5 - 31.8	Acceptable	EPA 8260B
4450	Carbon disulfide	µg/L	< 2.00	0.00		Acceptable	EPA 8260B
0058	Carbon tetrachloride	µg/L	33.5	26.5	14.9 - 36.5	Acceptable	EPA 8260B
0064	Chlorobenzene	µg/L	101	82.6	59.6 - 103	Acceptable	EPA 8260B
0061	Chlorodibromomethane	µg/L	28.3	21.9	14.7 - 29.0	Acceptable	EPA 8260B
4485	Chloroethane	µg/L	< 2.00	0.00		Acceptable	EPA 8260B
4500	2-Chloroethylvinylether	µg/L	< 5.00	0.00		Acceptable	EPA 8260B
0055	Chloroform	µg/L	89.7	67.8	46.9 - 87.1	Not Acceptable	EPA 8260B
4960	Chloromethane	µg/L	< 5.00	0.00		Acceptable	EPA 8260B
4570	1,2-Dibromo-3-chloropropane (DBCP)	µg/L	< 5.00	0.00		Acceptable	EPA 8260B
4585	1,2-Dibromoethane (EDB)	µg/L	< 2.00	0.00		Acceptable	EPA 8260B
4595	Dibromomethane	µg/L	91.6	70.7	48.4 - 95.5	Acceptable	EPA 8260B
0094	1,2-Dichlorobenzene	µg/L	< 2.00	0.00		Acceptable	EPA 8260B
0096	1,3-Dichlorobenzene	µg/L	87.9	70.0	47.5 - 89.1	Acceptable	EPA 8260B
0095	1,4-Dichlorobenzene	µg/L	82.3	65.5	44.4 - 82.1	Not Acceptable	EPA 8260B
4625	Dichlorodifluoromethane (Freon 12)	µg/L	< 5.00	0.00		Acceptable	EPA 8260B
4630	1,1-Dichloroethane	µg/L	< 2.00	0.00		Acceptable	EPA 8260B
0054	1,2-Dichloroethane	µg/L	103	74.5	51.7 - 97.7	Not Acceptable	EPA 8260B
4640	1,1-Dichloroethylene	µg/L	43.8	33.2	17.4 - 48.4	Acceptable	EPA 8260B
4645	cis-1,2-Dichloroethylene	µg/L	35.8	27.7	19.2 - 37.0	Acceptable	EPA 8260B
4700	trans-1,2-Dichloroethylene	µg/L	< 2.00	0.00		Acceptable	EPA 8260B
4655	1,2-Dichloropropane	µg/L	< 2.00	0.00		Acceptable	EPA 8260B
4680	cis-1,3-Dichloropropylene	µg/L	35.0	29.7	20.8 - 38.6	Acceptable	EPA 8260B

ACCREDITED Lab Code: 1539-01

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

Amy Rice
Quality Systems Specialist
Alpha Analytical
8 Walkup Drive
Westborough, MA 01581
508-439-5138

EPA ID: MA00030
ERA Customer Number: W574801
Report Issued: 12/10/10
Study Dates: 10/08/10 - 11/22/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Volatiles (cat# 830) (Continued)							
4685	trans-1,3-Dichloropropylene	µg/L	< 2.00	0.00		Acceptable	EPA 8260B
0066	Ethylbenzene	µg/L	21.6	17.9	12.0 - 23.5	Acceptable	EPA 8260B
4835	Hexachlorobutadiene	µg/L	72.8	61.8	6.18 - 77.2	Acceptable	EPA 8260B
4860	2-Hexanone	µg/L	172	117	59.9 - 171	Not Acceptable	EPA 8260B
0063	Methylene chloride	µg/L	17.8	13.8	8.20 - 20.7	Acceptable	EPA 8260B
4995	4-Methyl-2-pentanone (MIBK)	µg/L	< 5.00	0.00		Acceptable	EPA 8260B
5005	Naphthalene	µg/L	< 2.00	0.00		Acceptable	EPA 8260B
5100	Styrene	µg/L	56.4	45.3	29.4 - 61.6	Acceptable	EPA 8260B
5105	1,1,1,2-Tetrachloroethane	µg/L	< 2.00	0.00		Acceptable	EPA 8260B
5110	1,1,2,2-Tetrachloroethane	µg/L	< 2.00	0.00		Acceptable	EPA 8260B
0059	Tetrachloroethylene	µg/L	56.6	51.0	28.3 - 66.7	Acceptable	EPA 8260B
0067	Toluene	µg/L	34.0	27.4	19.1 - 34.8	Acceptable	EPA 8260B
5155	1,2,4-Trichlorobenzene	µg/L	140	104	22.9 - 124	Not Acceptable	EPA 8260B
0056	1,1,1-Trichloroethane	µg/L	38.9	30.3	19.0 - 40.4	Acceptable	EPA 8260B
5165	1,1,2-Trichloroethane	µg/L	< 2.00	0.00		Acceptable	EPA 8260B
0057	Trichloroethylene	µg/L	47.6	38.8	24.6 - 51.1	Acceptable	EPA 8260B
5175	Trichlorofluoromethane	µg/L	< 2.00	0.00		Acceptable	EPA 8260B
5180	1,2,3-Trichloropropane (TCP)	µg/L	< 2.00	0.00		Acceptable	EPA 8260B
5225	Vinyl acetate	µg/L	< 2.00	0.00		Acceptable	EPA 8260B
5235	Vinyl chloride	µg/L	29.9	22.2	8.88 - 35.5	Acceptable	EPA 8260B
5260	Xylenes, total	µg/L	< 4.00	0.00		Acceptable	EPA 8260B
WP PCBs in Water (cat# 832S)							
0040	Aroclor 1016	µg/L	< 0.200	0.00		Acceptable	EPA 8082A
8885	Aroclor 1221	µg/L	< 0.200	0.00		Acceptable	EPA 8082A
0042	Aroclor 1232	µg/L	< 0.200	0.00		Acceptable	EPA 8082A
0040	Aroclor 1242	µg/L	< 0.200	0.00		Acceptable	EPA 8082A
0044	Aroclor 1248	µg/L	4.46	4.35	1.80 - 6.13	Acceptable	EPA 8082A
0045	Aroclor 1254	µg/L	< 0.200	0.00		Acceptable	EPA 8082A
0046	Aroclor 1260	µg/L	< 0.200	0.00		Acceptable	EPA 8082A

ACCREDITED Lab Code: 1539-01

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

ERA
A Waters Company

WP-189 Final Complete Report

Amy Rice
Quality Systems Specialist
Alpha Analytical
8 Walkup Drive
Westborough, MA 01581
508-439-5138

EPA ID: MA00030
ERA Customer Number: W574801
Report Issued: 12/10/10
Study Dates: 10/08/10 - 11/22/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Base/Neutrals (cat# 833)							
5500	Acenaphthene	µg/L	81.2	75.4	30.3 - 90.4	Acceptable	EPA 8270C
5505	Acenaphthylene	µg/L	< 0.500	0.00		Acceptable	EPA 8270C
5145	2-Amino-1-methylbenzene (o-toluidine)	µg/L		0.00		Not Reported	
5545	Aniline	µg/L	< 0.500	0.00		Acceptable	EPA 8270C
5555	Anthracene	µg/L	118	105	44.2 - 131	Acceptable	EPA 8270C
5595	Benzidine	µg/L	< 5.00	0.00		Acceptable	EPA 8270C
5575	Benzo(a)anthracene	µg/L	80.8	68.7	31.1 - 87.3	Acceptable	EPA 8270C
5585	Benzo(b)fluoranthene	µg/L	41.3	36.4	12.5 - 50.3	Acceptable	EPA 8270C
5600	Benzo(k)fluoranthene	µg/L	47.4	40.0	9.17 - 60.6	Acceptable	EPA 8270C
5590	Benzo(g,h,i)perylene	µg/L	< 0.500	0.00		Acceptable	EPA 8270C
5580	Benzo(a)pyrene	µg/L	45.0	40.8	12.4 - 53.6	Acceptable	EPA 8270C
5630	Benzyl alcohol	µg/L	< 0.500	0.00		Acceptable	EPA 8270C
5660	4-Bromophenyl-phenylether	µg/L	222	191	60.6 - 253	Acceptable	EPA 8270C
5670	Butylbenzylphthalate	µg/L	188	150	30.8 - 212	Acceptable	EPA 8270C
5680	Carbazole	µg/L	0.940	0.00		Not Acceptable	EPA 8270C
5745	4-Chloroaniline	µg/L	< 0.500	0.00		Acceptable	EPA 8270C
5760	bis(2-Chloroethoxy)methane	µg/L	< 0.500	0.00		Acceptable	EPA 8270C
5765	bis(2-Chloroethyl)ether	µg/L	114	105	28.5 - 128	Acceptable	EPA 8270C
5780	bis(2-Chloroisopropyl)ether	µg/L	103	95.2	23.9 - 117	Acceptable	EPA 8270C
5790	1-Chloronaphthalene	µg/L		0.00		Not Reported	
5795	2-Chloronaphthalene	µg/L	41.9	38.3	11.1 - 47.4	Acceptable	EPA 8270C
5825	4-Chlorophenyl-phenylether	µg/L	184	160	59.6 - 198	Acceptable	EPA 8270C
5855	Chrysene	µg/L	19.2	24.0	10.5 - 34.2	Acceptable	EPA 8270C
5895	Dibenz(a,h)anthracene	µg/L	< 0.500	0.00		Acceptable	EPA 8270C
5905	Dibenzofuran	µg/L	43.5	39.7	15.0 - 52.6	Acceptable	EPA 8270C
5925	Di-n-butylphthalate	µg/L	< 14.0	0.00		Acceptable	EPA 8270C
4610	1,2-Dichlorobenzene	µg/L	< 0.500	0.00		Acceptable	EPA 8270C
4615	1,3-Dichlorobenzene	µg/L	32.5	32.1	4.73 - 40.0	Acceptable	EPA 8270C
4620	1,4-Dichlorobenzene	µg/L	< 0.500	0.00		Acceptable	EPA 8270C
5945	3,3'-Dichlorobenzidine	µg/L	< 0.500	0.00		Acceptable	EPA 8270C
6070	Diethylphthalate	µg/L	141	119	22.0 - 163	Acceptable	EPA 8270C
6135	Dimethylphthalate	µg/L	187	150	15.0 - 216	Acceptable	EPA 8270C

ACCREDITED Lab Code: 1539-01

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

ERA
A Waters Company

WP-189 Final Complete Report

Amy Rice
Quality Systems Specialist
Alpha Analytical
8 Walkup Drive
Westborough, MA 01581
508-439-5138

EPA ID: MA00030
ERA Customer Number: W574801
Report Issued: 12/10/10
Study Dates: 10/08/10 - 11/22/10

Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Base/Neutrals (cat# 833) (Continued)							
6185	2,4-Dinitrotoluene	µg/L	138	116	43.3 - 143	Acceptable	EPA 8270C
6190	2,6-Dinitrotoluene	µg/L	189	160	67.2 - 200	Acceptable	EPA 8270C
6200	Di-n-octylphthalate	µg/L	61.2	51.3	15.5 - 78.0	Acceptable	EPA 8270C
6065	bis(2-Ethylhexyl)phthalate	µg/L	92.1	54.8	16.6 - 78.5	Not Acceptable	EPA 8270C
6265	Fluoranthene	µg/L	163	153	66.8 - 181	Acceptable	EPA 8270C
6270	Fluorene	µg/L	118	104	45.1 - 124	Acceptable	EPA 8270C
6275	Hexachlorobenzene	µg/L	95.1	80.0	34.5 - 99.0	Acceptable	EPA 8270C
4835	Hexachlorobutadiene	µg/L	74.1	67.8	6.78 - 83.9	Acceptable	EPA 8270C
6285	Hexachlorocyclopentadiene	µg/L	< 0.500	0.00		Acceptable	EPA 8270C
4840	Hexachloroethane	µg/L	151	150	15.9 - 175	Acceptable	EPA 8270C
6315	Indeno(1,2,3-cd)pyrene	µg/L	< 0.500	0.00		Acceptable	EPA 8270C
6320	Isophorone	µg/L	< 0.500	0.00		Acceptable	EPA 8270C
6385	2-Methylnaphthalene	µg/L	124	115	23.0 - 132	Acceptable	EPA 8270C
5005	Naphthalene	µg/L	< 0.500	0.00		Acceptable	EPA 8270C
6460	2-Nitroaniline	µg/L	< 0.500	0.00		Acceptable	EPA 8270C
6465	3-Nitroaniline	µg/L	< 0.500	0.00		Acceptable	EPA 8270C
6470	4-Nitroaniline	µg/L	< 0.500	0.00		Acceptable	EPA 8270C
5015	Nitrobenzene	µg/L	< 0.500	0.00		Acceptable	EPA 8270C
6525	N-Nitrosodiethylamine	µg/L		0.00		Not Reported	
6530	N-Nitrosodimethylamine	µg/L	134	170	17.0 - 198	Acceptable	EPA 8270C
6535	N-Nitrosodiphenylamine	µg/L	< 0.500	0.00		Acceptable	EPA 8270C
6545	N-Nitroso-di-n-propylamine	µg/L	143	131	40.6 - 164	Acceptable	EPA 8270C
6590	Pentachlorobenzene	µg/L		0.00		Not Reported	
6615	Phenanthrene	µg/L	49.7	40.5	20.2 - 51.8	Acceptable	EPA 8270C
6665	Pyrene	µg/L	83.9	73.3	24.2 - 101	Acceptable	EPA 8270C
5095	Pyridine	µg/L	< 0.500	0.00		Acceptable	EPA 8270C
6715	1,2,4,5-Tetrachlorobenzene	µg/L	< 0.500	0.00		Acceptable	EPA 8270C
5155	1,2,4-Trichlorobenzene	µg/L	160	150	34.2 - 176	Acceptable	EPA 8270C

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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Acids (cat# 834)							
5610	Benzoic acid	µg/L	< 2.00	0.00		Acceptable	EPA 8270C
5700	4-Chloro-3-methylphenol	µg/L	45.8	38.4	13.6 - 49.5	Acceptable	EPA 8270C
5800	2-Chlorophenol	µg/L	81.4	76.8	23.1 - 97.1	Acceptable	EPA 8270C
6000	2,4-Dichlorophenol	µg/L	84.6	77.6	24.2 - 97.8	Acceptable	EPA 8270C
6005	2,6-Dichlorophenol	µg/L		0.00		Not Reported	
6130	2,4-Dimethylphenol	µg/L	141	144	31.8 - 188	Acceptable	EPA 8270C
6360	4,6-Dinitro-2-methylphenol	µg/L	92.8	84.1	24.6 - 116	Acceptable	EPA 8270C
6175	2,4-Dinitrophenol	µg/L	159	132	13.2 - 183	Acceptable	EPA 8270C
6400	2-Methylphenol	µg/L	77.3	80.4	15.2 - 100	Acceptable	EPA 8270C
6410	4-Methylphenol	µg/L	56.7	62.2	6.22 - 82.6	Acceptable	EPA 8270C
6490	2-Nitrophenol	µg/L	97.5	88.6	23.2 - 114	Acceptable	EPA 8270C
6500	4-Nitrophenol	µg/L	62.7	106	10.6 - 144	Acceptable	EPA 8270C
6605	Pentachlorophenol	µg/L	73.7	64.4	14.1 - 89.0	Acceptable	EPA 8270C
6625	Phenol	µg/L	< 0.500	0.00		Acceptable	EPA 8270C
6735	2,3,4,6-Tetrachlorophenol	µg/L	< 0.500	0.00		Acceptable	EPA 8270C
6835	2,4,5-Trichlorophenol	µg/L	131	108	38.5 - 138	Acceptable	EPA 8270C
6840	2,4,6-Trichlorophenol	µg/L	99.9	88.4	28.2 - 112	Acceptable	EPA 8270C
WP Low-Level PAHs (cat# 836)							
5500	Acenaphthene	µg/L	4.73	6.73	3.44 - 7.97	Acceptable	EPA 8270 SIM
5505	Acenaphthylene	µg/L	5.93	8.01	4.03 - 9.46	Acceptable	EPA 8270 SIM
5555	Anthracene	µg/L	1.32	1.63	0.475 - 2.22	Acceptable	EPA 8270 SIM
5575	Benzo(a)anthracene	µg/L	0.952	1.17	0.712 - 1.34	Acceptable	EPA 8270 SIM
5585	Benzo(b)fluoranthene	µg/L	1.56	1.95	0.807 - 2.37	Acceptable	EPA 8270 SIM
5600	Benzo(k)fluoranthene	µg/L	0.781	0.857	0.444 - 1.07	Acceptable	EPA 8270 SIM
5590	Benzo(g,h,i)perylene	µg/L	1.05	1.22	0.424 - 1.60	Acceptable	EPA 8270 SIM
5580	Benzo(a)pyrene	µg/L	1.08	1.22	0.497 - 1.56	Acceptable	EPA 8270 SIM
5855	Chrysene	µg/L	0.725	0.887	0.500 - 1.15	Acceptable	EPA 8270 SIM
5895	Dibenz(a,h)anthracene	µg/L	1.05	1.27	0.388 - 1.75	Acceptable	EPA 8270 SIM
6265	Fluoranthene	µg/L	1.11	1.31	0.764 - 1.58	Acceptable	EPA 8270 SIM
6270	Fluorene	µg/L	5.38	7.20	3.17 - 8.38	Acceptable	EPA 8270 SIM
6315	Indeno(1,2,3-cd)pyrene	µg/L	1.09	1.19	0.552 - 1.49	Acceptable	EPA 8270 SIM
5005	Naphthalene	µg/L	5.11	7.42	2.85 - 8.16	Acceptable	EPA 8270 SIM
6615	Phenanthrene	µg/L	1.45	1.77	0.904 - 2.09	Acceptable	EPA 8270 SIM
6665	Pyrene	µg/L	0.760	0.948	0.547 - 1.16	Acceptable	EPA 8270 SIM

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Report Issued: 12/10/10
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Anal. No.	Analyte	Units	Reported Value	Assigned Value	Acceptance Limits	Performance Evaluation	Method Description
WP Organochlorine Pesticides (cat# 831)							
0047	Aldrin	µg/L	6.22	5.88	1.66 - 8.11	Acceptable	EPA 8081B
7110	alpha-BHC	µg/L	9.04	7.46	3.24 - 10.2	Acceptable	EPA 8081B
7115	beta-BHC	µg/L	13.7	14.6	6.13 - 19.6	Acceptable	EPA 8081B
7105	delta-BHC	µg/L	17.6	14.7	5.67 - 20.5	Acceptable	EPA 8081B
7120	gamma-BHC(Lindane)	µg/L	8.92	7.14	2.92 - 9.84	Acceptable	EPA 8081B
7240	alpha-Chlordane	µg/L	5.85	5.47	2.46 - 7.41	Acceptable	EPA 8081B
7245	gamma-Chlordane	µg/L	8.00	7.24	2.96 - 9.81	Acceptable	EPA 8081B
0049	4,4'-DDD	µg/L	10.2	8.84	3.22 - 12.5	Acceptable	EPA 8081B
0050	4,4'-DDE	µg/L	4.06	4.53	1.99 - 5.93	Acceptable	EPA 8081B
0051	4,4'-DDT	µg/L	1.98	2.00	0.753 - 2.98	Acceptable	EPA 8081B
0048	Dieldrin	µg/L	12.6	10.8	5.32 - 14.6	Acceptable	EPA 8081B
7540	Endrin	µg/L	4.99	4.01	1.52 - 6.08	Acceptable	EPA 8081B
7530	Endrin aldehyde	µg/L	10.2	8.37	2.39 - 12.7	Acceptable	EPA 8081B
7535	Endrin ketone	µg/L	6.32	5.97	3.28 - 8.66	Acceptable	EPA 8081B
7510	Endosulfan I	µg/L	7.35	8.82	2.50 - 12.7	Acceptable	EPA 8081B
7515	Endosulfan II	µg/L	6.22	6.55	2.19 - 8.90	Acceptable	EPA 8081B
7520	Endosulfan sulfate	µg/L	5.28	4.76	1.76 - 6.95	Acceptable	EPA 8081B
0052	Heptachlor	µg/L	10.2	9.06	2.93 - 12.3	Acceptable	EPA 8081B
0078	Heptachlor epoxide (beta)	µg/L	4.11	3.78	1.84 - 5.33	Acceptable	EPA 8081B
7810	Methoxychlor	µg/L	7.90	7.77	2.04 - 12.3	Acceptable	EPA 8081B
WP Chlordane (cat# 837)							
0053	Chlordane, technical	µg/L	9.20	9.66	3.62 - 14.0	Acceptable	EPA 8081B
WP Toxaphene (cat# 838)							
8250	Toxaphene	µg/L	22.9	24.9	2.49 - 45.1	Acceptable	EPA 8081B
WP Diesel Range Organics (DRO) in Water (cat# 641)							
9369	Diesel Range Organics (DRO)	µg/L	1710	2630	623 - 3410	Acceptable	EPA 8015D

ACCREDITED Lab Code: 1539-01

All analytes are included in ERA's A2LA accreditation. Lab Code: 1539-01

APPENDIX E

LABORATORY SOPS AND FIELD SCREENING PROCEDURES

Accutest Laboratories
Standard Operating Procedure

Lab Manager _____

QA Manager _____

Effective Date 9-11-09

TEST NAME: METHOD 8260B, VOLATILE ORGANIC COMPOUNDS BY GAS CHROMATOGRAPHY/ MASS SPECTROMETRY (GC/MS)

METHOD REFERENCE: SW846 8260B (Revision 2, December 1996)

Revised Section: 2.8

1.0 SCOPE AND APPLICATION

1.1 This SOP describes the analytical procedures, which are utilized by Accutest to acquire samples for analysis of volatile organic compounds by gas chromatographic/mass spectrometric (GC/MS) following purge and trap utilizing the internal standard technique. The compounds in Table 1 may be determined by this method. An option has been included for the analysis of 1,4-Dioxane by selected ion monitoring GC/MS (GC/SIM-SIM).

1.2 This analytical method is designed for nearly all types of samples, regardless of water content, including ground water, aqueous sludges, liquors, waste solvents, oily wastes, tars, filter cakes, sediments and soils.

1.3 The applicable concentration range of this method is compound, matrix, and instrument dependent. Volatile water-soluble compounds can be included in this analytical technique. However, for some low-molecular weight halogenated hydrocarbons, aromatics, ketones, nitriles, acetates, acrylates, ethers, and sulfides, quantitation limits are approximately ten times higher because of poor purging efficiency. Determination of some structural isomers (i.e. xylenes) may also be hampered by coelution.

2.0 SUMMARY OF METHOD

2.1 Volatile compounds are introduced into the gas chromatograph by purge-and-trap (Method 5030/5035). Method 5030 may be used directly on ground water samples. Method 5035 is used for low-concentration and medium-concentration soils, sediments, and wastes. Medium concentration samples are preserved and stored in methanol prior to purge-and-trap analysis.

2.2 An inert gas is bubbled through a 5 ml sample contained in a specifically designed purging chamber at ambient temperature. The purgeables are efficiently transferred from the aqueous phase to the vapor phase. The vapor is swept through a sorbent column where the purgeables are trapped. After purging is completed, the sorbent column is heated and backflushed with the inert gas to desorb the purgeables onto a gas chromatographic (GC) column.

2.3 The volatile compounds are separated by the temperature programmed GC column and detected using a mass spectrometer, which is used to provide both qualitative and quantitative information.

2.4 The peaks detected are qualitated by comparison to characteristic ions and retention times specific to the known target list of compounds.

2.5 Once identified the compound is quantitated by comparing the response of major (quantitation) ion relative to an internal standard technique with an average response factor generated from a calibration curve.

2.5 Once identified the compound is quantitated by comparing the response of major (quantitation) ion relative to an internal standard technique with an average response factor generated from a calibration curve.

2.6 Additional unknown peaks with a response > 10 % of the closest internal standard may be processed through a library search with comparison to a database of approximately 75,000 spectra. An estimated concentration is quantitated by assuming a response factor of 1.

2.7 Water soluble volatile organic and other poor purging compounds maybe analyzed using this methodology, however this method is not the method of choice for these compounds and the laboratory's ability to achieve all calibration and quality control criteria for this method cannot be guaranteed. These compounds are noted as (pp) in Table 7.

2.8 The method includes an analytical option for the analysis of 1,4-Dioxane by GC/MS-SIM. The selected ions that are characteristic of the analytes of interest are analyzed using lower concentrations of calibration standards under the same MS conditions. SIM analysis is performed upon client request and is documented in the report.

3.0 REPORTING LIMIT AND METHOD DETECTION LIMIT

3.1 Reporting Limit. The reporting limit for this method is established at the lowest concentration standard in the calibration curve and may vary depending on matrix interferences, sample volume or weight and percent moisture. Detected concentrations below this concentration cannot be reported without qualification. See Table 10.

3.1.1 Compounds detected at concentrations between the reporting limit and MDL are quantitated and qualified as "J", estimated value. Program or project specifications may dictate that "J" qualified compounds are not to be reported.

3.2 Method Detection Limit. Experimentally determine MDLs using the procedure specified in 40 CFR, Part 136, Appendix B. This value represents the lowest reportable concentration of an individual compound that meets the method qualitative identification criteria.

3.2.1 Experimental MDLs must be determined annually for this method.

3.2.2 Process all raw data for the replicate analysis in each MDL study. Forward the processed data to the QA group for archiving.

4.0 DEFINITIONS

BLANK - an analytical sample designed to assess specific sources of laboratory contamination. See individual types of Blanks: Method Blank, Instrument Blank, Storage Blank, Cleanup Blank and Sulfur Blank.

4-BROMOFLUOROBENZENE (BFB) - the compound chosen to establish mass spectral instrument performance for volatile (VOA) analyses.

CALIBRATION FACTOR (CF) - a measure of the gas chromatographic response of a target analyte to the mass injected. The calibration factor is analogous to the Relative Response Factor (RRF) used in the Volatile and Semivolatile fractions.

CONTINUING CALIBRATION - analytical standard run every 12 hours to verify the initial calibration of the system.

CONTINUOUS LIQUID-LIQUID EXTRACTION - used herein synonymously with the terms continuous extraction, continuous liquid extraction, and liquid extraction. This extraction technique involves boiling the extraction solvent in a flask and condensing the solvent above the aqueous sample. The condensed solvent drips through the sample, extracting the compounds of interest from the aqueous phase.

EXTRACTED ION CURRENT PROFILE (EICP) - a plot of ion abundance versus time (or scan number) for ion(s) of specified mass (Es).

INITIAL CALIBRATION - analysis of analytical standards for a series of different specified concentrations; used to define the linearity and dynamic range of the response of the mass spectrometer to the target compounds.

INTERNAL STANDARDS - compounds added to every standard, blank, matrix spike, matrix spike duplicate, sample (for volatiles), and sample extract (for semivolatiles) at a known concentration, prior to analysis. Internal standards are used as the basis for quantitation of the target compounds.

MATRIX - the predominant material of which the sample to be analyzed is composed. For the purpose of this SOP, a sample matrix is either water or soil/sediment. Matrix is not synonymous with phase (liquid or solid).

MATRIX SPIKE - aliquot of a matrix (water or soil) fortified (spiked) with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery.

MATRIX SPIKE DUPLICATE - a second aliquot of the same matrix as the matrix spike (above) that is spiked in order to determine the precision of the method.

METHOD BLANK - an analytical control consisting of all reagents, internal standards and surrogate standards that is carried throughout the entire analytical procedure. The method blank is used to define the level of laboratory, background and reagent contamination.

METHOD DETECTION LIMITS (MDLs) - The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. MDLs should be determined approximately once per year for frequently analyzed parameters.

PERCENT DIFFERENCE (%D) - As used in this SOP and elsewhere to compare two values, the percent difference indicates both the direction and the magnitude of the comparison, i.e., the percent difference may be either negative, positive, or zero. (In contrast, see relative percent difference.)

PERCENT MOISTURE - an approximation of the amount of water in a soil/sediment sample made by drying an aliquot of the sample at 105°C. The percent moisture determined in this manner also includes contributions from all compounds that may volatilize at or below 105 °C, including water. Percent moisture may be determined from decanted samples and from samples that are not decanted.

PRIMARY QUANTITATION ION - a contract specified ion used to quantitate a target analyte.

REAGENT WATER - water in which an interferant is not observed at or above the minimum detection limit of the parameters of interest.

RECONSTRUCTED ION CHROMATOGRAM (RIC) - a mass spectral graphical representation of the separation achieved by a gas chromatograph: a plot of total ion current versus retention time.

RELATIVE PERCENT DIFFERENCE (RPD) - As used in this SOP and elsewhere to compare two values, the relative percent difference is based on the mean of the two values, and is reported as an absolute value, i.e., always expressed as a positive number or zero. (In contrast, see percent difference.)

RELATIVE RESPONSE FACTOR (RRF) - a measure of the relative mass spectral response of an analyte compared to its internal standard. Relative Response Factors are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples.

RELATIVE RETENTION TIME (RRT) - the ratio of the retention time of a compound to that of a standard (such as an internal standard).

INSTRUMENT BLANK – a system evaluation sample containing lab reagent grade water with internal standards and surrogate standards added. An instrument blank is used to remove and/or evaluate residual carryover from high level standards, spike samples and field samples.

5.0 HEALTH & SAFETY

5.1 The analyst must follow normal safety procedures as outlined in the Accutest Health and Safety Plan and Personal Protection Policy, which include the use of safety glasses and lab coats. In addition, all acids are corrosive and must be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical must be treated as a potential health hazard. Exposure to these reagents must be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets must be made available to all personnel involved in these analyses.

5.3 The following analytes covered by this method have been tentatively classified as known or suspected, human or mammalian carcinogens: benzene, carbon tetrachloride, 1,4-dichlorobenzene, 1,2-dichlorethane, hexachlorobutadiene, 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, chloroform, 1,2-dibromoethane, tetrachloroethene, trichloroethene, and vinyl chloride. Primary standards of these toxic compounds must be prepared in a hood. A NIOSH/Mass approved toxic gas respirator should be worn when the analyst handles high concentrations of these toxic compounds.

6.0 INTERFERENCES

6.1 The data from all blanks, samples, and spikes must be evaluated for interferences.

6.2 Impurities in the purge gas, organic compounds out-gassing from the plumbing ahead of the trap, and solvent vapors in the laboratory account for the majority of contamination problems. The

analytical system must be demonstrated to be free from contamination under the conditions of the analysis by running laboratory reagent blanks. The use of non-TFE tubing, non-TFE thread sealants, or flow controllers with rubber components in the purging device should be avoided.

6.3 Samples can be contaminated by diffusion of volatile organics (particularly methylene chloride and fluorocarbons) through the septum seal into the sample during shipment and storage. A trip blank prepared from reagent water and carried through the sampling and handling protocol can serve as a check on such contamination.

6.4 Contamination by carry-over can occur whenever high level and low-level samples are sequentially analyzed.

6.4.1 Whenever an unusually concentrated sample is encountered, it should be followed by an analysis of an instrument blank to check for cross contamination. Refer to Table 11 for compounds that may cause carryover for this method.

6.4.2 It may be necessary to wash the purging device with methanol, rinse it with organic-free water, and then dry the purging device in an oven at 105^0 C. Follow the instrument manual for instructions on cleaning. Document the occurrence in the maintenance log and notify the manager/supervisor.

6.4.2.1 Clean and bake purging tube.

6.4.2.2 Clean or replace purge needle.

6.4.2.3 Clean and bake sample filter or sparge filter.

6.4.2.4 Clean and bake sample loop.

6.4.2.5 Replace trap if necessary.

6.4.2.6 Replace water management module if necessary.

6.4.2.7 Rinse transfer line with methanol. Caution: disconnect the trap before rinsing.

6.4.3 In extreme situations, the entire purge-and trap device may require dismantling and cleaning. Follow the instrument's manual for instructions on disassembly. Document the occurrence in the maintenance log and notify the manager/supervisor. Screening of the samples prior to purge-and-trap GC/MS analysis is highly recommended to prevent contamination of the system. This is especially true for soil and waste samples.

6.4.4 If the contamination has been transferred to gas chromatograph, any of the following approaches may be used to cleanup the instrument.

6.4.4.1 Baking out the column between analyses.

6.4.4.2 Change the injector liner to reduce the potential for cross-contamination.

6.4.4.3 Remove a portion of the analytical column in the case of extreme contamination.

6.4.5 The oven temperature program must include a post-analysis bake out period to ensure that semivolatile hydrocarbons are stripped from the chromatographic column.

6.4 Special precautions must be taken during the analysis to avoid contamination from methylene chloride and other common laboratory solvents.

6.5.1 The sample storage and analytical area should be isolated from all atmospheric sources of methylene chloride or other common solvents.

6.5.2 Laboratory clothing worn by the analyst should be clean and used in designated areas only. Clothing previously exposed to solvent vapors in the organics sample preparation laboratory can contribute to sample contamination.

7.0 SAMPLE HANDLING AND PRESERVATION AND HOLDING TIME

7.1 HANDLING and PRESERVATION

7.1.1 Water samples

7.1.1.1 Container - 40 ml glass screw-cap VOA vial with Teflon-faced silicone septum. The 40-ml glass VOA vials are pre-cleaned and certified.

7.1.1.2 Collect all samples in duplicate. Test all samples for residual chlorine using test paper for free and total chlorine. If samples contain residual chlorine, three milligrams of sodium thiosulfate should be added for each 40 ml of water sample.

7.1.1.3 Fill sample bottles to overflowing, but do not flush out the dechlorinating agent. Sample should be taken with care so as to prevent any air or bubbles entering vials creating headspace.

7.1.1.4 Adjust the pH of all samples to ≤ 2 at the time of collection, but after dechlorination, by carefully adding two drops of 1:1 HCl for each 40 ml of sample. Seal the sample bottles, Teflon face down, and mix for one minute.

Note: Do not mix the sodium thiosulfate with the HCl in the sample bottle prior to sampling.

7.1.1.5 The samples must be protected from light and refrigerated at 2 - 6 °C from the time of receipt until analysis.

7.1.2 Soil Samples

7.1.2.1 Refer to the SOP for SW846 Method 5035 for preservation requirement of non-aqueous solids. ForOhio VAP freezing is not allowed; samples must be preserved with sodium bisulfate.

7.2 HOLDING TIME

7.2.1 Water Samples.

7.2.1.1 All samples are to be analyzed within 14 days of sampling (HCl preserved for aqueous sample) unless otherwise specified by the contract. If aqueous

samples are received unpreserved, the client is notified of the deficiency and the samples must be analyzed within 7 days. The sample preservation deficiency is noted on the chain of custody.

7.2.2 Soil Samples

7.2.2.1 Refer to the SOP for SW846 Method 5035 for holding time requirement of non-aqueous solids.

7.2.2.2 All samples are analyzed within 14 days of sampling unless otherwise specified.

8.0 APPARATUS AND MATERIALS

8.1 SYRINGE

8.1.1 10, 25, 50, 100, 500 and 5000 µl graduated syringes, manually held (Hamilton/equiv.).

8.1.2 5 ml and 50 ml glass gas tight syringes with Luerlok end, if appropriate for the purging device.

8.2 BALANCE

8.2.1 Analytical balance capable of weighing 0.0001 gram.

8.2.2 Top loading balance capable of weighing 0.1 gram.

8.3 PURGE AND TRAP DEVICES

8.3.1 The autosampler models are used for purging, trapping and desorbing the sample into GC column.

- O.I. Model 4560 sample concentrator with 4551 vial multi-sampler
- O.I. Model 4560 sample concentrator with 4552 Water/Soil multi-sampler

8.3.2 The sample purge vial must be designed to accept 5 ml samples with a water column at least 3 cm deep.

8.3.3 The auto-sampler is equipped with a heater capable of maintaining the purge chamber at 40 °C to improve purging efficiency. The heater is to be used for low level soil/sediment analysis, but not for water or medium level soil/sediment analysis.

8.3.4 The OI #10 trap is 42 cm with an inside diameter of 0.105 inches. The trap must be packed to contain the following absorbents (3-ring) and should be conditioned at 180 °C for 30 minutes by backflushing with a Helium gas flow at least 20 ml/min before initial use.

- Tenax (2,6-Diphenylene oxide polymer).
- Silica gel.
- Carbon Molecule Sieve (CMS).

8.3.5 The desorber should be capable of rapidly heating the trap to 190^0 C for desorption. Do not exceed 210 ^{0}C during bake-out mode. Alternatively, follow manufacturer's instructions.

8.3.6 The response of chloromethane and bromonethane can be tracked for thermal decomposition products formed. If levels over the calibration requirement, the trap must be replaced and the system re-calibrated after the manager/supervisor been notified.

8.4 GAS CHROMATOGRAPH/MASS SPECTROMETER SYSTEM

8.4.1 Gas Chromatograph.

8.4.1.1 An analytical system complete with a temperature programmable gas chromatograph and all required accessories including syringes, analytical columns, and gases.

8.4.1.2 The injection port should be suitable for split or splitless with appropriate interface.

8.4.1.3 The narrow bore capillary column is directly coupled to the source for HP-6890 model.

8.4.1.4 The wide bore capillary column is interfaced through a jet separator to the source for HP-5890 model.

8.4.2 Column.

- 75 m x 0.53mm ID x 3 µm film thickness capillary column coated with DB-624 (J&W Scientific), or equivalent. Condition as per manufactures directions.
- 105 m x 0.53mm ID x 3 µm film thickness capillary column coated with HP-VOA, or equivalent. Condition as per manufactures directions.
- 60 m x 0.25mm ID x 1.4 µm film thickness capillary column coated with DB-624 (J&W Scientific), or equivalent. Condition as per manufactures directions.
- 60 m x 0.45mm ID x 1.7 µm film thickness capillary column coated with DB-VRX (J&W Scientific), or equivalent. Condition as per manufactures directions.

8.4.3 Mass Spectrometer.

8.4.3.1 HP5973 or HP5970 is capable of scanning from 35 to 300 amu every 2 seconds or less, utilizing a 70 volt (nominal) electron energy in the electron impact ionization mode.

8.4.3.2 The mass spectrometer must be capable of producing a mass spectrum which meets all the criteria in Table 3 when injecting or purging 50 ng of the GC/MS tuning standard - Bromofluorobenzene (BFB).

8.4.3.3 SIM Mode – Capable of selective ion grouping at specified retention times for increased compound sensitivity (Table 2a).

8.5 DATA SYSTEM

8.5.1 Data Acquisition and Instrument Control (HP Chemstation) - A computer system is interfaced to the mass spectrometer, which allows the continuous acquisition and storage on a machine-readable media (disc) of all mass spectra obtained throughout the duration of the chromatographic program.

8.5.2 Data Processing (HP Enviroquant) - The software accommodates searching of GC/MS data file for target analytes which display specific fragmentation patterns. The software also allows integrating the abundance of an EICP between specified time or scan number limits. The data system includes the recent version of the EPA/NBS or NIST98 mass spectral library for qualitative searches of non-target compounds present in the chromatogram. The data system flags all data files that have been edited manually by laboratory personnel.

8.5.3 Off line Magnetic Tape Storage Device (Lagato Networker) - The magnetic tape storage device copies data for long-term, off-line storage.

9.0 REAGENTS AND STANDARDS

9.1 Solvent

9.1.1 Methanol: purge-and-trap grade quality or equivalent. Store separately, away from the other solvents.

9.2 Reagent Water

9.2.1 Reagent water is defined as water in which an interferant is not observed at the method detection limit of the parameters of interest.

9.2.2 Reagent water is generated by either passing tap water through a bed of approximately one pound of activated carbon or by using the water purification system at Accutest that is a series of deionizers and carbon cartridges.

9.3 Stock Standard Solutions

9.3.1 Commercially prepared standards used.

9.3.1.1 EPA Method 524.2 Volatiles (78 components): Absolute (or equivalent) at 200 µg/ml or 2,000 µg/ml concentration.

9.3.1.2 Custom Volatiles Mix A: Restek (or equivalent) at 2,000 µg/ml concentration.

9.3.1.3 Custom Volatiles Mix B: Restek (or equivalent) at 2,000 - 100,000 µg/ml concentration.

9.3.1.4 VOC Gas Mixture: Ultra (or equivalent) contains 200 µg/ml or 2,000 µg/ml of the following compounds in methanol.

- Bromomethane
- Chloroethane
- Chloromethane
- Dichlorodifluoromethane
- Trichlorofluoromethane
- Vinyl Chloride

9.3.1.5 Multiple neat compounds.

9.3.1.6 Surrogate standard mixture: Ultra (or equivalent) at a concentration of 2,500 µg/ml each surrogate compound.

- 1,2-Dichloroethane-d_4
- Dibromofluoromethane
- Toluene-d_8
- 4-Bromofluorobenzene

9.3.1.7 Internal standard mixture: Ultra (or equivalent) at a concentration of 2,000 µg/ml for all the compounds except Tert Butyl Alcohol-d_9, which is from Absolute (or equivalent) at a concentration of 50,000 µg/ml. The following five internal standards are used that exhibit similar analytical behavior to the compounds of interest.

- 1,4-Dichlorobenzene-d_4
- 1,4-Difluorobenzene
- Chlorobenzene-d_5
- Pentafluorobenzene
- Tert Butyl Alcohol-d_9

9.3.1.8 1,4-Dioxane Solution for SIMS : Ultra (or equivalent) at 100 µg/ml in methanol .

9.3.2 Unopened stock standard (ampoules) must be stored according to manufacturer's documented holding time and storage temperature recommendations (usually placed on the ampoule).

9.3.3 After opened, stock standards, internal standards, and surrogate solutions must be replaced after 6 months (one month for purgeable gases standard) or sooner if manufacture expiration date come first or comparison with quality control check samples indicates degradation.

9.3.4 Store all stock standards in vials with minimal headspace and Teflon lid liners after open, protect from light, and refrigerate to –10°C or colder or as recommended by the standard manufacturer.

9.3.5 Return the standards to the freezer as soon as the analyst has completed mixing or diluting the standards to prevent the evaporation of volatile target compounds.

9.4 Internal Standard and Surrogate Solution

9.4.1 Five internal standard and surrogate spiking solutions are prepared in methanol per Table 8.A.

9.4.1.1 25 µg /ml internal standard and surrogate mixture.

9.4.1.2 250 µg /ml internal standard and surrogate mixture.

9.4.1.3 100 µg/ml surrogate mixture.

9.4.1.4 25 µg /ml internal standard mixture.

9.4.1.5 250 µg /ml internal standard mixture.

9.4.2 A calibration range must be constructed for the surrogate compounds. Accordingly, appropriate amounts of surrogates are mixed with each calibration solution to define a range similar to the target compounds.

9.4.3 Each 5 ml sample, QC sample, and blank undergoing analysis should be spiked with any one of the above spiking solutions (depending upon the type of standards addition modules used), resulting in a concentration of 50 µg/l of each compound.

9.4.4 Prepare fresh internal standard and surrogate spiking solutions every six months, or sooner, if manufacturer's expiration dates come first or if the solution has degraded or evaporated.

9.5 Secondary Dilution Standards

9.5.1 Using stock standard solutions, prepare secondary dilution standards in methanol containing the compounds of interest, either singly or mixed together.

9.5.1.1 100 µg /ml V8260 mixture: prepared from 2,000 µg /ml stock solution. (see Table 8-C)

9.5.1.2 100 µg /ml V8260 custom mixture: prepared from 2,000 µg /ml stock solution. (see Table 8-C)

9.5.1.3 100 µg /ml Gas mixture: prepared from 2,000 µg /ml stock solution. (see Table 8-C)

9.5.2 Replace after one month for non-gas mixtures (one week for gas mixtures) or sooner if manufacture expiration date come first or comparison with quality control check samples indicates degradation.

9.5.3 Store all secondary dilution standards in vials with no headspace and Teflon lid liners, protect from light, and refrigerate to – 10°C or colder or according to manufacturer's storage temperature recommendation.

9.5.4 Return the standards to the freezer as soon as preparation is finished to prevent the evaporation of volatile compounds.

9.6 Aqueous Calibration Standard Solutions

9.6.1 Initial Calibration Standards

9.6.1.1 Prepare a minimum of five aqueous calibration standard solutions containing the surrogate compounds as Table 8-D.1 or 8-D.2.

9.6.1.2 To prepare a calibration standard, add a measured volume of secondary dilution standard solutions and the surrogate spiking solution to an aliquot of reagent water in the flask. Use a micro-syringe and rapidly inject the methanol standard into the expanded area of the filled volumetric flask. Remove the needle as quickly as possible after injection. Bring to volume. Mix by inverting the flask three times only. Discard the contents contained in the neck of the flask.

9.6.1.2.1 1,4-Dioxane for SIMS analysis is prepared from primary stock standard (100ppm).

9.6.2 Continuing Calibration Standard

9.6.2.1 A continuing calibration standard at a concentration of 50 µg/l is prepared as the scheme outlined in Table 8-E.

9.6.3 Aqueous standards are not stable and may be stored up to 24 hours if held in Teflon sealed screw-cap vials with zero headspace at 4^{0}C (± 2^{0}C). Protect the standards from light. If not so stored, they must be discarded after use, unless they are set up to be purged by an autosampler.

9.6.4 When using an autosampler, standards may be retained up to 12 hours if they are in purge tubes connected via the autosampler to the purge and trap device.

9.7 Second Source Calibration Check Standard (ICV)

9.7.1 Prepare the second source calibration check standards from separate sources of stock standards from the calibration curve following the procedures in Section 9.6. At a minimum, an ICV should be analyzed with every initial calibration.

9.7.2 For 1,4-Dioxane via SIMS: Prepare the second source calibration check standard using 2.5 µl of a 1000ppm (Absolute or equivalent) to 50 mL of reagent water which yields a 50 ppb standard.

9.8 4-Bromofluorobenzene (BFB) Standard

9.8.1 Two BFB solutions are prepared in methanol per Table 8-B.

9.8.1.1 25 µg /ml solution for direct injection.

9.8.1.2 250 µg /ml solution for purging.

9.8.2 The solution must be replaced after 6 months or sooner if mass spectrum indicates degradation or if manufacture expiration date comes first.

10.0 CALIBRATION

10.1 Daily Maintenance. Routine Daily maintenance must be performed before any tuning, calibration or sample analysis activities are initiated. These include checks of the following items:

Purge and Trap Device:

Clean & bake purge tube
Bake trap and transfer lines
Check or refill internal/surrogate spike solution on SIM/SAM vials
Clean/replace syringe (if necessary)
Change and refill rinse bottle
Empty and rinse waste bottle

GC Oven: (if necessary)

Change septum
Change liner
Clip column, indicated by carbon build-up

10.2 Initial Calibration

10.2.1 The calibration range covered for routine analysis under RCRA, and SIM, employs standards of 1(specified compounds only), (2)*, 5, 10, 20, 50, 100, 200,(300 or 400)* µg/l. (*instrument dependent). A minimum of five standards must be run sequentially. The low calibration standard defines the reporting limit. Lower concentration standards (1.0 or 2.0 µg/l) may be needed to meet the reporting limit requirements of state specific regulatory programs. Refer to Table 8-D-1 and 8-D-2 for calibration standard preparation.

10.2.2 A calibration range must be constructed for each surrogate compound. Accordingly, add appropriate amounts of each surrogate compound to the calibration solution to define a range similar to the target compounds.

10.2.2.1 For most samples and spikes both the internal standard and the surrogate are added automatically. When doing an initial calibration surrogates are added manually. In order to compensate for the difference between the automatic and manual surrogate additions a correction factor must be applied to the amount of surrogate added in Table 8-D. To determine the correction factor divide the surrogate concentration from an automatic injection by the surrogate concentration from a manual injection for each of the surrogates. Average the result for each of the surrogates to determine the correction factor. Finally multiply the correction factor by the appropriate amount of surrogate from Table 8-D and add this amount to the standard.

10.2.3 For water and medium-level soil calibration: Transfer and fill up (no air space) each standard to labeled 40 ml vial and cap with Teflon septum, then place the vial into O.I. sample tray.

10.2.4 For low-level soil calibration: Transfer 5 ml of each standard to labeled 40 ml vial and cap with Teflon septum, then place the vial into O.I. sample tray.

10.2.4.1 When calibrating for Method 5035 low-level samples, if the sodium bisulfate option was used, add 1g of sodium bisulfate to the 40-ml vial before aliquot 5 ml of each standard into vial otherwise do not add sodium bisulfate. This is equivalent to the amount of sodium bisulfate added to the samples and will maintain a consistent purging efficiency of the compounds. Cap the vial with Teflon septum and place it into O.I sample tray.

10.2.5 The linear range covered by this calibration is the highest concentration standard.

10.2.6 Program the autosampler to add internal standard mixture to each standard. This results in a concentration of 50 µg/l for each internal standard.

10.2.6.1 For O.I. SIM spiker: Automatically adds 10 µl of 25 µg/ml internal standard solution (Section 9.4.1.4) to each standard.

10.2.6.2 For O.I. SAM spiker: Automatically adds 1 µl of 250 µg/ml internal standard solution (Section 9.4.1.5) to each standard.

10.2.7 Analyze the standard solutions using the conditions established in Section 11.0. Whenever the highest concentration standard is analyzed, it is usually followed by the analyses of two reagent water blanks. Further analysis may not proceed until the blank analysis is demonstrated to be free of interferences.

10.2.8 Each analyte is quantitatively determined by internal standard technique using the closest eluting internal standard and the corresponding area of the major ion. See Table 7.

10.2.9 The Response Factor (RF) is defined in Section 13.1. Calculate the mean RF for each target analyte using minimum of five RF values calculated from the initial calibration curve.

10.2.10 For the initial calibration to be valid, the following criteria must be met.

10.2.10.1 Five compounds (System Performance Check Compounds, SPCCs) are checked for a minimum average response factor. The minimum mean response factors are listed in Table 6. If the initial calibration criteria for SPCCs are not achieved, perform corrective action before completing the calibration

10.2.10.2 The % RSD for each individual Calibration Check Compound (CCC) must be less than 30 %. This check is used to identify gross instrument operating problems. If the initial calibration criteria for CCCs are not achieved, perform corrective action before completing the calibration.

10.2.10.3 The percent relative standard deviation (% RSD) (see Section 13.2) of all target analytes must be less than 15 %.

10.2.10.4 If the average response factor criteria cannot be achieved, and if the problem is associated with one or more of the standards, reanalyze the standards and recalculate the RSD. The instrument logbook should have clear documentation as to what the suspected problem was.

10.2.10.4.1 A calibration standard is allowed to be repeated only once; if the second trial fails, a new initial calibration must be performed. Notify the team leader/manager. Document this occurrence in the instrument log.

10.2.10.5 Alternately, if the average response factor criteria cannot be achieved, the calibration range can be narrowed by dropping the low or high point of the curve.

10.2.10.5.1 The changes to the upper end of the calibration range will affect the need to dilute samples above the range, while changes to the lower end will affect the overall sensitivity of the method. Consider the regulatory limits or action levels associated with the target analytes when adjusting the lower end.

10.2.10.6 If the average response factor criteria still cannot be achieved, employ an alternative calibration linearity model. Specifically, linear regression using a least squares approach may be employed.

10.2.10.6.1 If Linear regression is employed select the linear regression calibration option of the mass spectrometer data system. Do not force the regression line through the origin and do not employ 0,0 as a sixth calibration standard.

10.2.10.6.2 The correlation coefficient (r value) must be ≥0.99 for each compound to be acceptable.

10.2.10.6.3 Perform corrective action and recalibrate if the calibration criteria cannot be achieved.

10.2.10.7 The initial calibration criteria for this method applies to all additional compounds of concern specified by the client.

10.2.10.8 The relative retention times of each target analyte in each calibration standard should agree within 0.06 relative retention time units.

10.3 Initial Calibration Verification (ICV) - Second Source Calibration Check Standard

10.3.1 The calibration is verified with a calibration check standard at 50 µg/l from an external source (Section 9.7). It must be analyzed immediately following the initial calibration.

10.3.2 The percent difference (% D) (Section 13.3) for this standard must meet the criteria of 20% for all the target compounds.

10.3.2.1 If % D is greater than 20%, reanalyze the second source check. If the criteria cannot be met upon re-injection, re-prepare the second source solution using a fresh ampoule and repeat the process.

10.3.2.2 If the %D criteria cannot be achieved after re-preparation of the second source, prepare a third source and repeat the process. Make fresh calibration standards using one of the two standard sources that matches each other and repeat the initial calibration.

10.4 Continuing Calibration Verification Standard(CCV)

10.4.1 A continuing calibration verification standard at a concentration near mid-level of the initial calibration range (50 µg/l) must be acquired every 12 hrs or at the beginning of each analytical batch.

10.4.1.1 For water and medium level soil analysis: Transfer and fill up (no air space) the calibration verification standard to labeled 40 ml vial and cap with Teflon septum, then place the vial into O.I. sample tray. Analyze as per Section 11.7.

10.4.1.1.1 Vary the concentration of the continuing calibration verification standard on alternate verifications (i.e. every other calibration verification) using an alternative concentration standard. The standard selected must be lower than the midpoint calibration standard.

10.4.1.2 For low-level soil analysis: Transfer 5 ml of the calibration verification standard to labeled 40 ml vial and cap with Teflon septum, then place the vial into O.I. sample tray. Analyze as per Section 11.7.

10.4.1.2.1 When calibrating for Method 5035 low-level samples, if the sodium bisulfate option was used add 1g of sodium bisulfate to the 40-ml vial before aliquot 5 ml of the calibration verification standard into vial, otherwise do not use sodium bisulfate. This is equivalent to the amount of sodium bisulfate added to the samples and will maintain a consistent purging efficiency of the compounds. Analyze as per Section 11.7.

10.4.1.3 A continuing calibration standard is analyzed whenever the analyst suspects that the analytical system is out of calibration. If the calibration cannot be verified, corrective action is performed to bring the system into control. Analysis may not continue until the system is under control.

10.4.2 For the continuing calibration to be valid, all of the following specified criteria must be met.

10.4.2.1 The minimum RF for SPCC compound is shown on Table 6. Each SPCC compound in the calibration verification standard must meet its minimum response factor.

10.4.2.2 The percent difference (% D, see Section 13.3) for CCC must be less than 20%.

10.4.2.2.1 If the CCCs and SPCCs are not required analytes, such as the shortlist analysis for BTEX only, then all required project analytes must meet the 20 %D.

10.4.3 If the first continuing calibration verification does not meet criteria, a second standard may be injected after notify the team leader/manager and checking the system for defects.

10.4.3.1 A continuing calibration check is allowed to be repeated only once; if the second trial fails, a new initial calibration must be performed. In situations where the first check fails to meet the criteria, the instrument logbook should have clear documented notations as to what the problem was and what corrective action was implemented to enable the second check to pass.

10.4.3.2 If the calibration verification is being performed using an auto sampler for night batch, two (2) vials of standard solution are placed in the device for analysis. The second standard must meet continuing calibration criteria and is used for calibration verification. The second check may be discarded because of a purge failure or incorrect spike concentration provided the first calibration standard meets the requirement. In this case, the first calibration standard is used as calibration verification following team leader/manager approval. Document this occurrence on instrument log.

10.4.4 If the verification criteria cannot be achieved, a new initial calibration must be performed.

10.4.5 If any of the internal standard areas change by a factor of two (- 50% to + 100%) or the retention time changes by more than 30 seconds from the midpoint standard of the last initial calibration, the mass spectrometer must be inspected for malfunctions and corrections must be made, as appropriate.

10.4.5.1 Reanalyze the continuing calibration standard. New initial calibration is required if reanalyzed standard continues to fail the internal standard requirements.

10.4.5.2 All samples analyzed while the system was out of control must be reanalyzed following corrective action.

10.5 Corrective Action Maintenance For Failed Tuning and Calibration Procedures

10.5.1 Inability to achieve criteria for instrument tuning or calibration may indicate the need for instrument maintenance. Maintenance may include routine system cleaning and replacement of worn expendables or the need for outside service if the scope of the repair exceeds the capability of the staff.

10.5.2 If maintenance is performed on an instrument, return to control must be demonstrated before analysis can continue. Return to control is demonstrated as follows:

10.5.2.1 Successful instrument tune using PFTBA.

10.5.2.2 Successful tune verification by the analysis of 4-bromofluorobenzene.

10.5.2.3 Successful initial calibration or continuing calibration.

11.0 PROCEDURE

11.1 Instrument conditions.

11.1.1 Recommended instrument conditions are listed in Table 2 and 2a (SIM only). Modifications of parameters specified with an asterisk are allowed as long as criteria of calibration are met. Any modification should be approved by team leader/manger.

11.1.2 Optimize GC conditions for analyte separation and sensitivity. Once optimized, use the same GC conditions for the analysis of all standards, blanks, samples, and QC samples.

11.2 Purge and Trap Device conditions.

11.2.1 See Table 2.

11.2.2 Daily Maintenance. Routine Daily maintenance must be performed before any tuning, calibration or sample analysis activities are initiated. These include checks of the following items:

Purge and Trap Device:

- Clean & bake purge tube.
- Bake trap and transfer lines.
- Check or refill internal/surrogate spike solution on SIM/SAM vials.
- Clean/replace syringe (if necessary).
- Change and refill rinse bottle.
- Empty and rinse waste bottle.

11.3 Step 1: Daily GC/MS performance check.

11.3.1 Every 12 hours, either

- Inject 2 µl (50 ng) of BFB solution directly on column or
- Purge 10 µg/l of 5ml (50ng) to GC column.

11.3.2 The GC/MS system must be checked to verify acceptable performance criteria are achieved (see Table 3).

11.3.3 This performance test must be passed before any samples, blanks or standards are analyzed. Evaluate the tune spectrum using three mass scans from the chromatographic peak and a subtraction of instrument background.

11.3.3.1 Select the scans at the peak apex and one to each side of the apex.

11.3.3.2 Calculate an average of the mass abundances from the three scans.

11.3.3.3 Background subtraction is required. Select a single scan in the chromatogram that is absent of any interfering compound peaks and no

more than 20 scans prior to the elution of BFB. The background subtraction should be designed only to eliminate column bleed or instrument background ions. Do not subtract part of the tuning compound peak.

11.3.4 If all the criteria are not achieved, the analyst must retune the mass spectrometer with team leader/manager and repeat the test until all criteria are met.

11.3.4.5 Alternatively, an additional scan on each side of the peak apex may be selected and included in the averaging of the mass scans. This will provide a mass spectrum of five averaged scans centered on the peak apex. NOTE: The selection of additional mass scans for tuning may only be performed with supervisory approval on a case by case basis.

11.3.5 The injection time of the acceptable tune analysis is considered the start of the 12-hour clock.

11.3.6 Until performance check is acceptable, then calibration check (step 2) can be analyzed.

11.4 Step 2 : Daily calibration check

11.4.1 Initial calibration

11.4.1.1 Refer to Section 10.2.

11.4.1.2 An initial calibration must be established (or reestablished) on each instrument:

- Prior to any sample analyses;
- Whenever a new column is installed;
- Whenever instrument adjustments that affect sensitivity are made; and
- Whenever a continuing calibration standard fails to meet the specified acceptance criteria, on the second trial.

11.4.2 Initial Calibration Verification - Second Source Calibration Check Standard

11.4.2.1 This standard is only analyzed when initial calibration provided. Refer to Section 10.3.

11.4.3 Continuing Calibration verification standard

11.4.3.1 Refer to Section 10.4.

11.4.4 The method blank (step 3) cannot be analyzed until the continuing calibration verification meets the criteria.

11.5 Step 3 : Method blank

11.5.1 The acceptable method blank must be analyzed for every 12-hour time period or sooner.

11.5.1.1 Water and medium-level soil samples - Place a 40 ml vial, filled with DI water onto the autosampler.

11.5.1.2 Low-level soil samples without sodium bisulfate - Transfer 5 ml of DI water to a 40 ml vial and cap with Teflon septum, then place the vial into O.I. sample tray.

11.5.1.2.1 Low-level soil samples with sodium bisulfate (Method 5035) - Add 1g of sodium bisulfate to a 40 ml vial before aliquot 5 ml of DI water into the vial and cap with Teflon septum, then place the vial onto the autosampler.

11.5.2 Program the autosampler to add internal standard and surrogate solution to the method blank for a concentration of 50 µg/l for each internal standard and surrogate.

11.5.2.1 For O.I. SIM spiker: Automatically adds 10 µl of 25 µg/ml internal standard and surrogate solution (Section 9.4.1.1) to the method blank.

11.5.2.2 For O.I. SAM spiker: Automatically adds 1 µl of 250 µg/ml internal standard and surrogate solution (Section 9.4.1.2) to the method blank.

11.5.3 No compound can be present above the laboratory's MDL. If common laboratory solvents (i.e. methylene chloride, acetone) are present in the sample between the MDL and RL, the analyst must determine if the contamination will negatively impact data quality. If the contamination impacts data quality, all affected samples must be re-analyzed.

11.5.4 Surrogates must meet recovery criteria specified in house limits.

11.5.5 If the method blank does not meet surrogate criteria or contains target analytes above the MDL, then

11.5.5.1 All samples analyzed following an out of control method blank must be reanalyzed.

11.5.5.2 Check for the potential of contamination interference from the following areas. Make sure all items are free contamination.

- the analytical system,
- dust and vapor in the air,
- glassware and
- Reagents.

11.5.5.3 Re-analyze the method blank following the system evaluation. In this situation, the instrument logbook should have clear documented notations as to what the problem was and what corrective action was implemented to enable the second blank to pass.

11.5.5.4 If re-analyzed method blank remains out of control, notify team leader or manager.

11.5.6 If two consecutive method blanks are analyzed during unattended operations, the second analysis must meet criteria for the subsequent sample analysis to be valid. Always report the second method blank. The second analysis can only be discarded because of a purge failure provided that the first blank meets the

requirement. In this case, the first blank is reported following team leader/manager approval. Document this occurrence on the instrument log.

11.5.7 The blank spike (BS) (step 4) cannot be analyzed until the method blank meets criteria.

11.6 Step 4: Blank spike (BS)

11.6.1 An acceptable blank spike must be analyzed with every analytical batch. The maximum number of samples per analytical batch is twenty.

11.6.2 Spike 50 ml of reagent water with appropriate amount of the standards to prepare a blank spike containing 50 µg/L of each analyte. In situations where lower detection limits are required, a blank spike at 20 µg/L may be prepared. The stock solution for the BS must be from a different source than the initial calibration solution. Refer to Table 8-F for the preparations of the blank spikes.

11.6.2.1 Water and medium-level soil samples - Place a 40 ml vial, filled with DI water onto the autosampler.

11.6.2.2 Low-level soil samples without sodium bisulfate - Aliquot 5 ml of the blank spike into vial and cap with Teflon septum, then place the vial into O.I. sample tray.

11.6.2.2.1 Low-level soil samples with sodium bisulfate for Method 5035 - Add 1g of sodium bisulfate to labeled 40 ml vial before aliquot 5 ml of the blank spike into vial and cap with Teflon septum, then place the vial into O.I. sample tray.

11.6.3 Initiate auto addition of internal standard and surrogate into the syringe per 11.5.2.

11.6.4 Compare the percent recoveries (% R) (see Section 13.5) to the in house limits acceptance criteria. If a blank spike is out of control, all the associated samples must be reanalyzed. The exception is if the blank spike recovery is high and no hits reported in associated samples and QC batch. In that case, the sample results can be reported with footnote (remark) and no further action is required.

11.6.5 Do not analyze samples and MS/MSD (step 5) unless the BS meets acceptance criteria.

11.7 Step 5: Samples /MS/MSD analysis

11.7.1 All samples and standard solutions must be allowed to warm to ambient temperature before analysis.

11.7.2 Select the sample dilution factor to assure the highest concentration analyte is above the calibration range midpoint, but below the upper limit of the range depend on project requirements. See Table 9 for dilution guideline.

- Utilize FID screen data.
- Utilize acquired sample data.
- Utilize the history program.
- Sample characteristics (appearance, odor).

11.7.3 Water samples.

11.7.3.1 Using O.I.Model 4560 sample concentrator with 4551 or 4552 vial multisampler,

- Place the 40 ml vial in the tray, or
- Load 5ml sample into purge tube if sample volume limited.

11.7.4 Sediment/ soil sample

11.7.4.1 Low-level soil method

11.7.4.1.1 Collect the sample using the procedures detailed in the SOP for SW846 Method 5035 low - level soil samples.

11.7.4.1.2 Weigh out 5 g of each sample into a labeled vial. Add 5 ml of reagent water and cap the vial quickly. Transfer the 40ml vial to the autosampler tray. Stir and heat the sample at the time of analysis.

11.7.4.2 Medium-level soil method

11.7.4.2.1 Collect the sample using the procedures detailed in the SOP for SW846 Method 5035 medium - level soil samples.

11.7.4.2.2 Select a methanol aliquot of appropriate volume (see Table 9) determined via screening and transfer to 40 ml of reagent water.

11.7.5 Program the autosampler to inject the internal standard and surrogate solution into the robotic syringe used to withdraw sample from the 40 ml vial. This addition to 5 ml of sample is equivalent to a concentration of 50 µg/L of each internal standard and surrogate.

11.7.5.1 For O.I. SIM spiker: Automatically adds 10 µl of 25 µg/ml internal standard and surrogate solution (Section 9.4.1.1) to each sample.

11.7.5.2 For O.I. SAM spiker: Automatically adds 1 µl of 250 µg/ml internal standard and surrogate solution (Section 9.4.1.2) to each sample.

11.7.6 Purge the sample for 11 minutes with Helium.

11.7.6.1 Low-level soil sample must be performed at 40 °C while the sample is being agitated with the magnetic stirring bar or other mechanical means.

11.7.6.2 To improve the purging efficiency of water-soluble compounds, aqueous samples may also be purged at 40 °C as long as all calibration standards, samples and QC samples are purged at the same temperature and acceptable method performance is demonstrated.

11.7.7 One sample is randomly selected from each analytical batch of similar matrix types and spiked in duplicate to determine whether the sample matrix contributes bias to the analytical results. A matrix spike and matrix spike duplicate are performed by spiking the sample for a concentration of 50 µg/l or 50 µg/kg based on 5 g dry weight. In situations where lower detection limits are required, a blank spike at lower concentration may be prepared.

11.7.8 Desorb the sample for 4 minutes by rapidly heating the trap to 190 °C while backflushing with Helium. Desorb time may require performance optimum between 2.0 and 4.0 minutes as dictated by trap manufacturers specifications or instrument characteristics.

11.7.9 Program the purge and trap system to automatically rinse purge tube at least twice with heated organic-free water (reagent water) between analyses to avoid carryover of target compounds. For samples containing large amounts of water-soluble materials, suspended solids, high-boiling compounds, or high purgeable levels, it may be necessary to wash out the purging device with methanol solution between analyses, rinse it with distilled water.

11.7.10 Bake the trap at least 10 minutes at 210 °C to remove any residual purgeable compounds.

11.7.11 If the initial analysis of the sample or a dilution of the sample has a response for any ion of interest that exceeds the working range of the GC/MS system, the sample must be reanalyzed at a higher dilution.

11.7.11.1 When ions from a compound in the sample saturate the detector, this analysis must be followed by the analysis of reagent water blank. If the blank analysis is not free of interferences, then the system must be decontaminated. Sample analysis may not resume until the blank analysis is demonstrated to be free of interferences.

11.8 Sample dilutions

11.8.1 Using Screening Data to Determine Dilution Factors

11.8.1.1 Dilution for High Concentration Analytes Exceeding The Calibration Range

11.8.1.1.1 The highest concentration target compound detected in the screen data is compared to the highest concentration calibration standard used for determinative volatile organics analysis.

11.8.1.1.1.1 Divide the calibration concentration of the highest concentration calibration standard by the screen concentration.

11.8.1.1.1.2 If the result is >1, sample dilution is considered.

11.8.1.1.2 The result from step 11.8.1.1.1 determines the dilution factor. The dilution factor is targeted to assure that the highest concentration diluted analyte is at the mid-range concentration of the calibration curve for the determinative analysis.

11.8.1.1.3 In all cases a conservative approach to dilution is applied to minimize the increase of detection and reporting limits

11.8.1.2 Dilution for High Concentration Matrix Interferences

11.8.1.2.1 The peak height of the background is compared to the peak height of the later eluting calibration standards from the screening analysis.

11.8.1.2.1.1 A rough estimate of background concentration is calculated by dividing the background peak height by the peak height of the selected screening standard and multiplying by its concentration.

11.8.1.2.2 If the result is >1, sample dilution is considered.

11.8.1.2.3 The result from step 11.8.1.2.1 determines the dilution factor. The dilution factor is targeted to avoid Carry-over contamination between samples and facilitate qualitative and quantitative analysis of target compounds present in the sample.

11.8.1.2.4 In all cases a conservative approach to dilution is applied to minimize the increase of detection and reporting limits

11.8.2 If the concentration of any target compound in any sample exceeds the initial calibration range, a new aliquot of that sample must be diluted and re-analyzed. Until the diluted sample is in a sealed sample vial, all steps in the dilution procedure must be performed without delay.

11.8.3 Water Samples.

11.8.3.1 Prepare all dilutions of water samples in volumetric flasks (10 ml to 100 ml). Intermediate dilutions may be necessary for extremely large dilutions.

11.8.3.2 Calculate the approximate volume of reagent water, which will be added to the volumetric flask, and add slightly less than this quantity to the flask. Refer to Table 9 for dilution guideline.

11.8.3.3 Inject the proper sample aliquot from a syringe into the volumetric flask. Dilute the flask to the volume mark with reagent water. Cap the flask and invert the flask three times.

11.8.3.4 Fill a 40 ml sample vial and seal with a Teflon baked silicon septa, load the diluted sample into the autosampler and analyze according to Section 11.7.

11.8.3 Low-level Soil Samples.

11.8.3.1 The screening data are used to determine which is the appropriate sample preparation procedure for the particular sample, the low-level soil method or the medium-level soil method.

11.8.3.2 If any target compound exceeds the initial calibration range from the analysis of 5 g sample, a smaller sample size must be analyzed. However, the smallest sample size permitted is 0.5 g. If smaller than 0.5 g sample size is needed to prevent any target compounds from exceeding the initial calibration range, the medium level method must be used.

11.9 Data interpretation

11.9.1 Qualitative identification.

11.9.1.1 The targeted compounds shall be identified by analyst with competent knowledge in the interpretation of mass spectra by comparison of the sample mass spectrum to the mass spectrum of a standard of the suspected compound.

11.9.1.2 The characteristic ions for target compounds that can be determined are listed in Table 7. Table 4 and Table 5 list the characteristic ions for internal standards and surrogate compounds respectively.

11.9.1.3 The criteria required for a positive identification are listed below.

11.9.1.3.1 The sample component must elute at the same relative retention time (RRT) as the daily standard. Criteria are the RRT of sample component must be within ± 0.06 RRT units of the standard component.

11.9.1.3.2 The relative intensities of these ions must agree within ± 30 % between the daily standard and sample spectra. (Example: For an ion with an abundance of 50 % in the standard spectra, the corresponding sample abundance must be between 20 and 80 %.)

11.9.1.3.2.1 Compounds can have secondary ions outside criteria from co-eluting compounds and/or matrix effect that can contribute to ion abundances. The interference on ion ratios can't always be subtracted out by software programs resulting in qualified compound identification.

11.9.1.3.2.2 Quantitation reports display compounds that have secondary ions outside the ratio criteria with a "#" flag.

11.9.1.3.2.3 Any quant reports with compounds that are deemed to be reportable despite the "#" flag, will be initialed in the "#" column by the analyst. Further review to the reporting of qualified compounds will be done by a supervisor or team leader and initialed on the quantitation.

11.9.1.3.3 Structural isomers that produce very similar mass spectra should be identified as individual isomers if they have sufficiently different GC retention times. Sufficient GC resolution is achieved if the height of the valley between two isomer peaks is less than 25 % of sum of the two peak heights. Otherwise, structural isomers are identified as isomeric pairs.

11.9.2 Quantitative analysis

11.9.2.1 Once a target compound has been identified, its concentration (Section 13.4) will be based on the integrated area of the quantitation ion, normally the base peak (Table 7). The compound is quantitated by internal standard technique with an average response factor generated from the initial calibration curve.

11.9.2.2 If the sample produces interference for the primary ion, use a secondary ion to quantitate (see Table 7). This is characterized by an excessive background signal of the same ion, which distorts the peak shape beyond a definitive integration. Also interference could severely inhibit the response of the internal standard ion. This secondary ion must also be used to generate new calibration response factors.

11.10 Library search for tentatively identified compounds.

11.10.1 If a library search is requested, the analyst should perform a forward library search of NBS or NIST98 mass spectral library to tentatively identify 15 non-reported compounds.

11.10.2 Guidelines for making tentative identification are listed below.

11.10.2.1 These compounds should have a response greater than 10 % of the nearest internal standard. The response is obtained from the integration for peak area of the Total Ion Chromatogram (TIC).

11.10.2.2 The search is to include a spectral printout of the 3 best library matches for a particular substance. The results are to be interpreted by analyst.

11.10.2.3 Molecular ions present in the reference spectrum should be present in the sample spectrum.

11.10.2.4 Relative intensities of major ions in the reference spectrum (ions > 10 % of the most abundant ion) should be present in the sample spectrum.

11.10.2.5 The relative intensities of the major ions should agree within ± 20 %. (Example: For an ion with an abundance of 50% in the standard spectrum, the corresponding sample ion abundance must between 30 and 70%).

11.10.2.6 Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of coeluting compounds.

11.10.2.7 Ions present in the reference spectrum but not in the sample spectrum should be verified by performing further manual background subtraction to eliminate the interference created by coeluting peaks and/or matrix interference.

11.10.2.8 Quantitation of the tentatively identified compounds is obtained from the total ion chromatogram based on a response factor of 1 and is to be tabulated on the library search summary data sheet.

11.10.2.9 The resulting concentration should be reported indicating: (1) that the value is estimate, and (2) which internal standard was used to determine concentration. Quantitation is performed on the nearest internal standard.

11.11 An instrument blank is a system evaluation sample containing lab reagent grade water with internal standards and surrogates. An instrument blank is used to remove and or evaluate residual carryover from high level standards, spike samples and field samples. Since target compound lists have expanded to overlap some volatile and semi-volatile compounds, instrument blanks are necessary to remove carryover contamination.

11.11.1 The compounds that may exhibit carryover for this method are listed in Table 11.

11.11.2 If instrument blanks following a standard or spike sample exhibits carrry-over effect, then any samples that show the same carryover profile, after a comparable concentration must be considered suspect and rerun for confirmation. For example, if an instrument blank has 1ppb detected after a 200ppb standard, then any sample following a sample containing 200ppb or above of the same compound must be confirmed for possible carryover.

11.11.3 If an Instrument Blank(s) was run following suspect high concentration samples and it exhibits the same carryover profile after a comparable concentration must be considered suspect and rerun for confirmation.

11.11.4 In some cases, several instrument blanks may have to be run to eliminate contamination from over loaded samples.

11.11.5 The analytical system is considered free of carryover, when no target analytes can be detected above the MDL.

11.12 Selected Ion Monitoring (SIM) Option Selected Ion Monitoring (SIM) Option

11.12.1 Instrument Set-Up: Modify the method for SIM analysis and define ion groups with retention times, ions and dwell times to include base peak ion for the target compounds of interest, surrogates, and internal standards (Table 2a.) Select a mass dwell time of 50 milliseconds for all compounds.

11.12.2 Calibration: Calibrate the mass spectrometer in the selected ion monitoring mode using 6 calibration standards of 5, 10, 20, 50, 100, 200 ug/l. Spike each standard with the SIM specific internal standard solution at 4ug/ml. Calculate individual response factors and response factor RSDs.

11.12.3 Initial Calibration Verification. Verify the initial calibration after its completion using a 50 ug/l calibration standard purchased or prepared from a second standards reference materials source. The initial calibration verification must meet the criteria of Section 10.2.

11.12.4 Continuing Calibration Verification. Verify the initial calibration every 12 hours using a 50 ug/l calibration. The continuing calibration verification must meet the criteria of Section 10.4.

11.12.5 Surrogate Standard Calculation.. Report surrogate spike accuracy for the surrogates spiked for the full scan GC/MS analysis.

12.0 QUALITY CONTROL

12.1 QC Requirements Summary

BFB	Beginning of the analytical shift and every 12 hours
Second Source Calibration Check Standard	Following initial calibration
Calibration Verification Standard	Every 12 hours
Method Blank	Every 12 hours

Blank Spike	One per analytical batch*
Matrix Spike	One per analytical batch*
Matrix Spike Duplicate	One per analytical batch*
Surrogate	Every sample and standard
Internal Standard	Every sample and standard

*The maximum number of samples per analytical batch is twenty.

12.2 Daily GC/MS Performance Check - BFB

12.2.1 Refer to Section 11.3.

12.3 Second Source Calibration Check Standard

12.3.1 Refer to Section 10.3.

12.3.2 Calibration Verification Standard

12.3.3 Refer to Section 10.4.

12.5 Method Blank

12.5.1 Refer to Section 11.5.

12.6 Blank Spike

12.6.1 Refer to Section 11.6.

12.7 Matrix Spike (MS)/Matrix Spike Duplicate (MSD)

12.7.1 One sample is selected at random from each analytical batch of similar matrix types and spiked in duplicate to check precision and accuracy.

12.7.2 Assess the matrix spike recoveries (Section 13.5) and relative percent difference (RPD) (Section 13.6) against the control limits..

12.7.3 If the matrix spike recoveries do not meet the criteria, check the blank spike recovery to verify that the method is in control. If the blank spike did not meet criteria, the method is out of control for the parameter in question and should be reanalyzed or qualified with an estimate of potential bias. Otherwise, matrix interference is assumed and the data is reportable. No further corrective action is required.

12.8 Surrogates

12.8.1 All standards, blanks, samples, and matrix spikes contain surrogate compounds, which are used to monitor method performance. If the recovery of any surrogate compound does not meet the control limits, the result must be flagged and:

12.8.1.1 The calculation must be checked.

12.8.1.2 The sample must be reanalyzed if the recovery of any one surrogate is out of control limit.

12.8.2 If the sample exhibits matrix interference, defined as excessive signal levels from target or non-target interfering peaks. In this case, reanalysis may not be required following team leader/manager approval.

12.8.3 If surrogate recoveries are acceptable upon reanalysis, the data from the reanalysis is reported. If the reanalysis date did not meet the hold time, then both sets of data must be submitted with the reanalysis reported.

12.8.4 If surrogates are still outside control limits upon reanalysis, then both sets of data should be submitted with the first analysis reported.

12.9 Internal Standard

12.9.1 Retention time for all internal standards must be within ± 30 seconds of the corresponding internal standard in the latest continuing calibration or 50 µg/l standard of initial calibration.

12.9.2 The area (Extracted Ion Current Profile) of the internal standard in all analyses must be within 50 to 200 % of the corresponding area in the latest calibration standard (12 hr. time period).

12.9.3 If area of internal standard does not meet control limits, the calculations must be checked. If a problem is not discovered, the sample must be reanalyzed.

12.9.4 If areas are acceptable upon reanalysis, the reanalysis data is reported.

12.9.5 If areas are unacceptable upon reanalysis, then both sets of data are submitted with the original analysis reported.

13.0 CALCULATION

13.1 Response Factor (RF)

$$RF = \frac{As \times Cis}{Ais \times Cs}$$

where:
As = Area of the characteristic ion for the compound being measured.
Ais = Area of the characteristic ion for the specific internal standard.
Cs = Concentration of the compound being measured (ug/l).
Cis = Concentration of the specific internal standard (ug/l).

13.2 Percent Relative Standard Deviation (% RSD)

$$\%RSD = \frac{SD}{RFav} \times 100$$

where:
SD = Standard Deviation
RFav = Average response factor from initial calibration.

13.3 Percent Difference (%D)

$$\%D = \frac{(RFav - RFcv)}{RFav} \times 100$$

where:
RFcv = Response factor from Calibration Verification standard.
RFav = Average response factor from initial calibration.

13.4 Concentration (Conc.)

For water:

$$\text{Conc. } (\mu g/l) = \frac{Ac \times Cis \times Vp}{Ais \times RF \times Vi}$$

For soil/sediment low level (on a dry weight basis):

$$\text{Conc. } (\mu g/kg) = \frac{Ac \times Cis \times Vp}{Ais \times RF \times Ws \times M}$$

For soil/ sediment medium level (on a dry weight basis)

$$\text{Conc. } (\mu g/kg) = \frac{Ac \times Cis \times Vp \times Vt}{Ais \times RF \times Vme \times Ws \times M}$$

Where:
Ac = Area of characteristic ion for compound being measured.
Ais = Area of characteristic ion for internal standard.
Cis = Concentration of internal standard
RF = Response factor of compound being measured(from initial calibration)
Vi = Initial volume of water purged (ml)
Vp = 5 ml (Total Purge Volume)
Vme = Volume of Methanol aliquot
Vt = Ml Solvent + ((100-% solid)/100 x Ws)
Ws = Weight of sample extracted (g).
M = (100 - % moisture in sample) / 100 or % solids / 100

13.5 Percent Recovery (% R)

$$\%R = \frac{\text{Concentration found}}{\text{Concentration spiked}} \times 100$$

13.6 Relative Percent Difference (RPD)

$$RPD = \frac{|MSC - MSDC|}{(1/2)(MSC+MSDC)} \times 100$$

Where:
MSC = Matrix Spike Concentration

MSDC = Matrix Spike Duplicate Concentration

13.7 Linear regression by the internal standard technique.

$$C_s = \left(\frac{\frac{A_s}{A_{is}} - b}{A} \right) \times C_{is}$$

Where:
Cs = concentration of target analyte
As = Area of target analyte
Cis = concentration of the internal standard
b = Intercept
a = slope of the line

$$a = \frac{N \Sigma xy - \Sigma x \Sigma y}{N \Sigma x^2 - (\Sigma x)^2}$$

$$b = \frac{\Sigma y - a \Sigma x}{N}$$

N = number of points
x = amount of analyte
y = response of instrument

13.8 Correlation Coefficient

$$r = \frac{\Sigma(x - \bar{x})(y - \bar{y})}{\sqrt{\Sigma(x - \bar{x})^2 \Sigma(y - \bar{y})^2}}$$

Where r = correlation coefficient
x = amount of analyte
y = response of instrument

$\bar{x}$ = average of x values

$\bar{y}$ = average of y values

14.0 DOCUMENTATION

14.1 The Analytical Logbook records the analysis sequence; the logbook must be completed daily. Each instrument will have a separate logbook.

14.1.1 If samples require reanalysis, a brief explanation of the reason must be documented in the Comments section.

14.2 Standards Preparation Logbook must be completed for all standard preparations. All information must be completed; the page must be signed and dated by the appropriate person.

14.2.1 The Accutest lot number must be cross-referenced on the standard vial.

14.3 Instrument Maintenance Logbook must be completed when any type of maintenance is performed on the instrument. Each instrument has a separate log.

14.4 Any corrections to laboratory data must be done using a single line through the error. The initials of the person and date of correction must appear next to the correction.

14.5 Supervisory (or peer) personnel must routinely review (at least once per month) all laboratory logbooks to ensure that information is being recorded properly. Additionally, the maintenance of the logbooks and the accuracy of the recorded information should also be verified during this review.

15.0 POLLUTION PREVENTION & WASTE MANAGEMENT

15.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 15.2.

15.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, EHS004. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:

15.2.1 Non hazardous aqueous wastes

15.2.2 Hazardous aqueous wastes

15.2.3 Chlorinated organic solvents

15.2.4 Non-chlorinated organic solvents

15.2.5 Hazardous solid wastes

15.2.6 Non-hazardous solid wastes

Table 1. TARGET COMPOUNDS		
Acetone	1,3-Dichlorobenzene	Methyl Methacrylate
Acetonitrile	1,4-Dichlorobenzene	4-Methyl-2-pentanone (MIBK)
Acrolein	Dichlorodifluoromethane	Methylene Bromide
Acrylonitrile	1,1-Dichloroethane	Methylene Chloride
Allyl Chloride	1,2-Dichloroethane	1-Methylnaphthalene (1)
Benzene	1,1-Dichloroethene	2-Methylnaphthalene (1)
Benzyl chloride	cis-1,2-Dichloroethene	Naphthalene
Bromobenzene	trans-1,2-Dichloroethene	2-Nitropropane (1)
Bromochloromethane	1,2-Dichloropropane	Pentachloroethane
Bromodichloromethane	1,3-Dichloropropane	Propionitrile
Bromoform	2,2-Dichloropropane	Propyl Acetate (1)
Bromomethane	1,1-Dichloropropene	n-Propylbenzene
2-Butanone (MEK)	cis-1,3-Dichloropropene	Styrene
Butyl Acetate (1)	trans-1,3-Dichloropropene	Tert Butyl Alcohol
n-Butyl Alcohol (1)	1,4-Dioxane	tert-Amyl Methyl Ether
n-Butylbenzene	Epichlorohydrin (1)	tert-Butyl Ethyl Ether
sec-Butylbenzene	Ethyl Acetate	1,1,1,2-Tetrachloroethane
tert-Butylbenzene	Ethyl Ether	1,1,2,2-Tetrachloroethane
Carbon Disulfide	Ethyl Methacrylate	Tetrachloroethene
Carbon Tetrachloride	Ethylbenzene	Tetrahydrofuran
Chlorobenzene	p-Ethyltoluene (1)	Toluene
Chlorodifluoromethane (1)	Freon 113	trans-1,4-Dichloro-2-Butene
Chloroethane	Heptane (1)	1,2,3-Trichlorobenzene
2-Chloroethyl Vinyl Ether	Hexachlorobutadine	1,2,4-Trichlorobenzene
Chloroform	Hexachloroethane	1,1,1-Trichloroethane
Chloromethane	Hexane (1)	1,1,2-Trichloroethane
Chloroprene (2-chloro-1,3-butadiene)	2-Hexanone	Trichloroethene
o-Chlorotoluene	Iodomethane (Methy iodide)	Trichlorofluoromethane
p-Chlorotoluene	IsoAmyl Alcohol (1)	1,2,3-Trichloropropane
Cyclohexane (1)	Isobutyl Alcohol	1,2,4-Trimethylbenzene
Cyclohexanone	Isopropyl Acetate (1)	1,3,5-Trimethylbenzene
di-Isobutylene (1)	Isopropylbenzene	Vinyl Acetate
di-Isopropyl Ether	p-Isopropyltoluene	Vinyl Chloride
1,2-Dibromo-3-Chloropropane	Methacrylonitrile	Vinyltoluene (1)
Dibromochloromethane	Methyl Acetate (1)	m,p-Xylene
1,2-Dibromoethane	3 Methyl-1-Butanol (1)	o-Xylene
Dibromomethane (1)	Methyl Tert Butyl Ether	Ethanol
1,2-Dichlorobenzene	Methylcyclohexane (1)	Methyl Acrylate

(1) NELAC Accreditation is not offered for this compound. Results may not be useable for regulatory purposes in States where this accreditation option is not offered.

Table 2. RECOMMENDED OPERATING CONDITION	
Gas Chromatograph/ Mass Spectrometer	
Carrier Gas (linear velocity)	Helium at *30 cm/sec
Mass range	35 – 300 amu
Electron Energy	70 volts (nominal)
Scan time	not to exceed 2 sec. per scan
Injection port temperature	200 - 225 °C
Source temperature	200 - 250 °C
Transfer line temperature	220 - 280 °C
Analyzer temperature	220 - 250 °C
Gas Chromatograph temperature program*	
Initial temperature	*40 °C
Time 1	*3 minutes
Column temperature rate	*8 degrees/min.
Final temperature	*220 °C.- 240 °C
Total run time	*25 – 50 mins
Purge and Trap Device	
Purge time	9 min. (at 40 °C for low-level soil) SIM – 6 min @ 50 °C
Desorb**	4 min. at 190 °C
Bake	>10 min. at 210 °C
Transfer line	100 - 130 °C
Valve temperature	approx. transfer line temperature

* Parameter modification allowed for performance optimization provided operational and QC criteria is achieved.(must be approved by team leader/manager)

** Desorb time may require performance optimum between 2.0 and 4.0 minutes as dictated by trap manufacturers specifications or instrument characteristics

Table 2a – SIM Group Parameters		
Group No.	**Retention Time (minutes)**	**Ions**
1	0 – 10.8	58, 65, 66, 88
2	10.8 – 16.0	95, 174, 176, 98, 100, 70

Table 3. BFB KEY IONS AND ION ABUNDANCE CRITERIA	
Mass	**Ion Abundance Criteria**
50	15-40% of mass 95
75	30-60% of mass 95
95	Base peak, 100% relative abundance
96	5-9% of mass 95
173	< 2% of mass 174
174	> 50% of mass 95
175	5-9% of mass 174
176	>95% and <101% of mass 174
177	5-9% of mass 176

Table 4. INTERNAL STANDARD QUANTITION IONS	
Internal Standard	**Primary/Secondary Ions**
1,4-Difluorobenzene	114 / 63,88
Chlorobenzene-d5	117 / 82, 119
Pentafluorobenzene	168
1,4-Dichlorobenzene-d4	152 / 115, 150
Tert Butyl Alcohol-d9	65/66
Internal Standard (SIM)	
Tert Butyl Alcohol-d9	65/66

Table 5. SURROGATE QUANTITION IONS	
Surrogate Compound	**Primary/Secondary Ions**
1,2 Dichloroethane – d_4	102
Dibromofluoromethane	113
Toluene-d8	98
4-Bromofluorobenzene	95 / 174, 176

Table 6. CRITERIA FOR CCC AND SPCC		
Initial Calibration	Maximum % RSD for CCC is 30 %	
Continuing Calibration	Maximum % D for CCC is 20 %	
Calibration check compounds (CCC)	**Volatile Compound**	
	Vinyl chloride 1,1-Dichloroethene Chloroform 1,2-Dichloropropane Toluene Ethylbenzene	
System Performance Check Compounds (SPCC)	**Compound Name**	**Minimum RF**
	Chloromethane	0.1
	1,1-Dichloroethane	0.1
	Bromoform	0.1
	1,1,2,2-Tetrachloroethane	0.3
	Chlorobenzene	0.3

Table 7. Volatile Internal Standards with Corresponding Analytes Assigned for Quantitation

Analyte	Primary Characteristic Ion	Secondary Characteristic Ion (s)	Analyte	Primary Characteristic Ion	Secondary Characteristic Ion (s)
Tert Butyl Alcohol-d9			Dibromomethane	93	95, 174
Tert Butyl alcohol	59	57	Di-isobutylene	57	
Ethanol	45	46	Epichlorohydrin (pp)	57	57, 49, 62, 51
Pentafluorobenzene			Ethyl methacrylate	69	69, 41, 99, 86, 114
1,1,1-Trichloroethane	97	99, 61	Heptane	57	
1,1-Dichlorethane	63	65, 63	Hexane	56	
1,1-Dichloroethene	96	61, 63	Isopropyl acetate	43	
2,2-Dichloropropane	77	97	Methyl cyclohexane	83	
2-Butanone (pp)	72	43, 72	Methyl methacrylate	69	69, 41, 100, 39
Acetone (pp)	58	43	n-Butanol (pp)	56	41
Acetonitrile (pp)	41	41, 40, 39	Propyl Acetate	43	
Acrolein (pp)	56	55,58	tert Amyl Methyl Ether	73	
Acrylonitrile (pp)	53	52, 51	Toluene	92	91
Allyl Chloride	41		Toluene-d_8	98	
Bromochloromethane	128	49, 130	trans-1,3-Dichloropropene	75	77, 39
Bromomethane	94	96	Trichloroethene	95	97, 130, 132
Carbon disulfide	76	78			
Chlorodifluouromethane	51	86	**Chlorobenzene-d5**	117	82,119
Chloroethane	64	66	1,1,1,2-Tetrachloroethane	131	133, 119
Chloroform	83	85	1,2-Dibromoethane	107	109, 188
Chloromethane	50	52	1,3-Dichloropropane	76	78
Chloroprene	53	53, 88, 90, 51	Bromoform	173	175, 254
cis-1,2-Dichloroethene	96	61, 98	Butyl Acetate	56	
Cyclohexane	84		Chlorobenzene	112	77, 114
Dibromofluoromethane	113		Dibromochloromethane	129	127
Dichlorodifluoromethane	85	87	Ethylbenzene	91	106
Dichloroethane-d_4	102	65	m-Xylene	106	91
Diethyl ether	74	45, 59	o-Xylene	106	91
Diisopropyl ether	45	102	p-Xylene	106	91
Ethyl acetate (pp)	88	43, 45, 61	Styrene	104	78
Ethyl tert Butyl Ether	59		Tetrachloroethene	164	129,131,166
Freon 113	151				
Iodomethane	142	127, 141	**1,4 Dichlorobenzene-d4**	152	115,150
Isobutyl alcohol (pp)	43	43, 41, 42, 74	1,1,2,2-Tetrachloroethane	83	131, 85
Methacrylonitrile (pp)	41	41, 67, 39, 52, 66	1,2,3-Trichlorobenzene	180	182, 145
Methyl Acetate	43	74	1,2,3-Trichloropropane	75	77
Methylene chloride	84	86, 49	1,2,4-Trichlorobenzene	180	182, 145
Methyl-t-butyl ether	73	57	1,2,4-Trimethylbenzene	105	120
Propionitrile (ethyl cyanide)(pp)	54	54, 52, 55, 40	1,2-Dibromo-3-chloropropane(pp)	75	155, 157
Tetrahydrofuran	42		1,2-Dichlorobenzene	146	111,148
trans-1,2-Dichloroethene	96	61, 98	1,3,5-Trimethylbenzene	105	120
Trichlorofluoromethane	151	101, 153	1,3-Dichlorobenzene	146	111, 148
Vinyl acetate	43	86	1,4-Dichlorobenzene	146	111, 148
Vinyl chloride	62	64	2-Chlorotoluene	91	126
Methyl Acrylate	55	85	4-Bromofluorobenzene	95	174, 176
1,4 Difluorobenzene	114	63, 88	4-Chlorotoluene	91	126
1,1,2-Trichloroethane	83	97, 85	Benzyl chloride	91	91, 126, 65, 128
1,1-Dichloropropene	75	110, 77	Bromobenzene	156	77, 158
1,2 Dichloroethane	62	98	Cyclohexanone	55	
1,2 Dichloropropane	63	112	Hexachlorobutadiene	225	223, 227
1,4-Dioxane (pp)	88	88, 58, 43, 57	Hexachloroethane (pp)	201	166, 199, 203
2-Chloroethyl-vinylether (pp)	63	65, 106	Isopropylbenzene	105	120

Table 7. Volatile Internal Standards with Corresponding Analytes Assigned for Quantitation

Analyte	Primary Characteristic Ion	Secondary Characteristic Ion (s)	Analyte	Primary Characteristic Ion	Secondary Characteristic Ion (s)
2 – Hexanone	43	58,57,100	Naphthalene	128	-
2-Hexanone (pp)	43	58, 57, 100	n-Butylbenzene	91	92, 134
2-Nitropropane	46	-	n-Propylbenzene	91	120
3 Methyl –1 butanol	55		Pentachloroethane (pp)	167	167,130,132,165,169
4-Methyl-2-pentanone (pp)	100	43, 58, 85	p-isopropyltoluene	119	134,91
Benzene	78	-	sec-Butylbenzene	105	134
Bromodichloromethane	83	85, 127	tert-Buytlbenzene	119	91, 134
Carbon tetrachloride	117	119	trans-1,4-Dichloro-2-butene (pp)	53	88, 75
cis-1,3-Dichloropropene	75	77, 39			
			(pp) = Poor Purging Efficiency		

Table 7-1 SIM - Volatile Internal Standards with Corresponding Analytes Assigned for Quantitation

Analyte	Primary Characteristic Ion	Secondary Characteristic Ion (s)
Tert Butyl Alcohol-d9		
1,4-Dioxane	88	58
Toluene –d8	98	100
4-BFB	95	174, 176

Table 8. STANDARDS PREPARATION

A) Internal standard and Surrogate mixtures:

	a) 25/250 µg/ml		b) 250/2,500 µg/ml	
Internal Standard Mixture (2,000 µg/ml)	1.25	ml	1.25	ml
Tert Butyl Alcohol-d_9 (50,000 µg/ml)	0.5	ml	0.5	ml
Surrogate Mixture (2,500 µg/ml)	1	ml	1	ml
Methanol	97.25	ml	7.25	ml
Total	100	ml	10	ml

- 25/250 µg /ml internal standard and surrogate mixture: The mixture is prepared by measuring 1.25ml of 2,000 µg /ml Internal Standard Mixture (Ultra or equivalent), 0.5 ml of 50,000 µg/ml TBA-d_9 (Absolute or equivalent), 1 ml of 2,500 µg /ml Method 8260A Surrogate Standard Mixture (Ultra or equivalent) and bringing to 100 ml with methanol.

- 250/2,500 µg /ml internal standard and surrogate mixture: The mixture is prepared by measuring 1.25 ml of 2,000 µg /ml Internal Standard Mixture (Ultra or equivalent), 0.5 ml of 50,000 µg/ml TBA-d_9 (Absolute or equivalent), 1 ml of 2,500 µg /ml Method 8260A Surrogate Standard Mixture (Ultra or equivalent) and bringing to 10 ml with methanol.

- 100 µg/ml surrogate mixture: The solution is prepared at 100 µg/ml by measuring 0.4 ml of 2,500 µg/ml Method 8260A Surrogate Standard Mixture (Ultra or equivalent) and bringing to 10 ml with methanol.

- 25/250 µg /ml internal standard mixture: The solution is prepared by measuring 1.25 ml of 2,000 µg /ml Internal Standard Mixture (Ultra or equivalent), 0.5 ml of 50,000 µg/ml TBA-d_9 (Absolute or equivalent), and bringing to 100 ml with methanol.

- 250/2,500 µg /ml internal standard mixture: The solution is prepared by measuring 1.25 ml of 2,000 µg /ml Internal Standard Mixture (Ultra or equivalent), 0.5 ml of 50,000 µg/ml TBA-d_9 (Absolute or equivalent), and bringing to 10 ml with methanol.

B) Bromofluorobenzene (BFB):

	a) 25 µg/ml		b)) 250 µg/ml	
BFB (25,000 µg/ml)	0.1	ml	0.1	ml
Methanol	99.9	ml	9.9	ml
Total	100	ml	10	ml

- 25 µg /ml solution for direct injection: The BFB is prepared at 25 µg /ml by measuring 0.1 ml of 25,000 µg /ml (Absolute Stock or equivalent) and diluting to 100 ml with methanol.

- 250 µg /ml solution for purging: The BFB is prepared at 250 µg /ml by measuring 0.1 ml of 25,000 µg /ml (Absolute Stock or equivalent) and diluting to 10 ml with methanol.

Table 8. STANDARD PREPARATION (Continued)

C) Secondary dilution standards:

2nd Dilution Standards	Stock Solution	Concentration (µg/ml)	Volume Added (µl)	Final Volume in Methanol (ml)	Final Concentration (µg/ml)
V8260 Mixture	EPA Method 524.2 Volatiles	2,000	2,500	50	100
	Acrolein	Neat (90%)	66.2		1,000
	Acrylonitrile*	Neat	25		500*
	Propionitrile**	Neat	58.9		1,000**
	Di-iso Butylene	Neat	7.1		100
	Cyclohexane	Neat	6.5		100
	Cyclohexanone	Neat	52.9		1,000
V8260 Custom Mixture	Custom Volatiles Mix A	2,000	2,500	50	100
	Custom Volatiles Mix B	2,000 -100,000	2,500		100 - 5,000
	Epichlorohydrin	Neat	21.4		500
	Iso-Amyl alcohol	Neat	125		2,000
	2-Chloroethyl vinyl ether	Neat	20.1		500
	Ethyl tert-butyl ether	Neat	6.8		100
	Tert-Amyl methyl ether	Neat	6.56		100
	Benzyl chloride	Neat	4.6		100
Gas Mixture	VOC Gas Mixture	2,000	1,000	20	100

- 100 µg /ml V8260 mixture: The mixture is prepared at 100 µg /ml by measuring 2 ml of 2,000 µg /ml EPA Method 524.2 Volatiles stock standard, appropriate amount of some neat compounds, and bringing to 50 ml with methanol.
  * Acrylonitrile = 400 µg /ml (Neat) + 100 µg /ml (EPA Method 524.2 Volatiles)
  ** Propionitrile = 900 µg /ml (Neat) + 100 µg /ml (EPA Method 524.2 Volatiles)

- 100 µg /ml V8260 custom mixture: The mixture is prepared at 100 - 5,000 µg /ml by measuring 2.5ml of 2,000 µg /ml Custom Volatiles Mix A, 2.5 ml of 2,000 - 100,000 µg/ml Custom Volatiles Mix B, appropriate amount of some neat compounds, and bringing to 50 ml with methanol.

- 100 µg /ml gas mixture ***: The mixture is prepared at 100 µg /ml by measuring 1 ml of 2,000 µg /ml stock standard and bring to 20 ml with methanol.
  *** Gas mixture should be prepared weekly.

Table 8. STANDARD PREPARATION (Continued)

D).1 Initial Calibration Standards: using DI water bring to 50 ml final volume: all mixtures used should be **secondary dilution** standards at **100 ppm.**

Standard and Surrogate Concentration	V8260 Mix (100 ppm)	V8260 Custom Mix (100 ppm)	Gas compound Mix (100 ppm)	Surrogate Mix (100ppm)
1 ppb	0.5 µl	0.5 µl	0.5 µl	0.5 µl#
2 ppb *	1.0 µl	1.0 µl	1.0 µl	1.0 µl#
5 ppb	2.5 µl	2.5 µl	2.5 µl	2.5 µl#
10 ppb *	5 µl	5 µl	5 µl	5 µl#
20 ppb	10 µl	10 µl	10 µl	10 µl#
50 ppb	25 µl	25 µl	25 µl	25 µl#
100 ppb	50 µl	50 µl	50 µl	50 µl#
200 ppb	100 µl	100 µl	100 µl	100 µl#
300 ppb *	150 µl	150 µl	150 µl	150 µl#
400 ppb *	200 µl	200 µl	200 µl	200 µl#

* depending upon the instrument.
\# See Section 10.2.2.1 for correction factor.

- When calibrating for Method 5035 low-level soil samples, add 1g of sodium bisulfate to the 40-ml vial before aliquot 5 ml of each standard into vial. This is equivalent to the amount of sodium bisulfate added to the samples and will maintain a consistent purging efficiency of the compounds.

D).2 Initial Calibration Standards for 1,4-Dioxane using SIMS

Standard and Surrogate Concentration (ppb)	1,4-Dioxane Solution (100ppm)	Surrogate Mix (100ppm)	DI Water – Final Volume (ml)
2	2 µl	1 µl	100
5	5 µl	2 µl	100
25	25 µl	5 µl	100
50	25 µl	2.5 µl	50
100	50 µl	5 µl	50
200	100 µl	10 µl	50
400	200 µl	20 µl	50

Table 8. STANDARD PREPARATION (Continued)

E) **Continuing Calibration Standard: using DI water bring to 50 ml final volume:** All mixtures used are secondary dilution standards at 100 ppm.

Concentration	V8260 Mix (100 ppm)	V8260 Custom Mix (100 ppm)	Gas compound Mix (100 ppm)
50 ppb	25 µl	25 µl	25 µl

- When calibrating for Method 5035 low-level soil samples, add 1g of sodium bisulfate to the 40-ml vial before aliquot 5 ml of the continuing calibration standard into vial. This is equivalent to the amount of sodium bisulfate added to the samples and will maintain a consistent purging efficiency of the compounds.

F) **Blank Spike (BS): using DI water bring to 50 ml final volume:** All mixtures used are 100 ppm secondary dilution standards.

Concentration	V8260 Mix (100 ppm)	V8260 Custom Mix (100 ppm)	Gas compound Mix (100 ppm)
50 ppb	25 ul	25 ul	25 ul

For lower detection level required (test code: V8260LL)

Concentration	V8260 Mix (100 ppm)	V8260 Custom Mix (100 ppm)	Gas compound Mix (100 ppm)
20 ppb	10 ul	10 ul	10 ul

- When calibrating for Method 5035 low-level soil samples, add 1g of sodium bisulfate to the 40-ml vial before aliquot 5 ml of the blank spike into vial. This is equivalent to the amount of sodium bisulfate added to the samples and will maintain a consistent purging efficiency of the compounds.

Table 9. GUIDELINE FOR DILUTION PREPARATION

Water Sample

Dilution	Sample amount taken	Final volume A (volumetric)	Take from final volume A	Final volume B (volumetric)
1:2	25 ml	50 ml		
1:5	10 ml	50 ml		
1:10	5 ml	50 ml		
1:20	2.5 ml	50 ml		
1: 25	2 ml	50 ml		
1:50	1 ml	50 ml		
1:100	0.5 ml	50 ml		
1:200	250 µl	50 ml		
1:250	200 µl	50 ml		
1:500	100 µl	50 ml		
1:1000	50 µl	50 ml		
1:2000	25 µl	50 ml		
1:2500	20 µl	50 ml		
1:5000	10 µl	50 ml		
1:10000	0.5 ml	50 ml	0.5 ml	50 ml
1:20000	0.5 ml	50 ml	250 µl	50 ml
1:25000	0.5 ml	50 ml	200 µl	50 ml
1:50000	0.5 ml	50 ml	100 µl	50 ml
1:100000	0.5 ml	50 ml	50 µl	50 ml

Soil-Low level (Non-Encore sample)

Dilution	Sample amount taken	Final volume
1:2	2.5 gram	5 ml
1:5	1 gram	5 ml
1:10	0.5 gram	5 ml

Soil-medium level

Additional Dilution	Sample in Methanol amount taken	Final volume (volumetric)
1:1	1 ml	50 ml
1:2	0.5 ml	50 ml
1:5	200 µl	50 ml
1:10	100 µl	50 ml
1:20	50 µl	50 ml
1: 25	40 µl	50 ml
1:50	20 µl	50 ml
1:100	10 µl	50 ml
1:200	5 µl	50 ml
1:250	4 µl	50 ml
1:500	2 µl	50 ml

Table 10. REPORTING LIMITS

Compound	Water	Soil	Compound	Water	Soil
	µg/l	µg/kg		µg/l	µg/kg
Chlorodifluoromethane	5	5	Chloroform	5	5
Dichlorodifluoromethane	5	5	Freon 113	5	5
Chloromethane	5	5	Methacrylonitrile	10	10
Vinyl chloride	5	5	Butyl Acetate	5	5
Bromomethane	5	5	1,1,1-Trichloroethane	5	5
Chloroethane	5	5	Heptane	5	5
Trichlorofluoromethane	5	5	n-Propyl acetate	5	5
Ethyl ether	5	5	2-Nitropropane	10	10
Acrolein	50	50	Tetrahydrofuran	10	10
1,1-Dichloroethene	2	2	2-Chloroethyl Vinyl Ether	20	20
Tertiary butyl alcohol	50	50	n-Butyl alcohol	250	250
Acetone	5	5	Cyclohexane	5	5
Methyl acetate	5	5	Carbon Tetrachloride	1	1
Allyl chloride	5	5	1,1-Dichloropropene	5	5
Acetonitrile	100	100	Isopropyl Acetate	5	5
Iodomethane	25	25	Benzene	1	1
Iso-butyl alcohol	50	50	1,2-Dichloroethane	2	2
Carbon disulfide	5	5	Trichloroethene	1	1
Methylene chloride	2	2	Methyl methacrylate	10	10
Methyl tert butyl ether	1	1	1,2 Dichloropropane	1	1
Trans-1,2-Dichloroethene	5	5	Di-isobutylene	5	5
Di-isopropyl ether	5	5	Dibromomethane	5	5
2-Butanone	5	5	1,4 Dioxane	125	125
1,1-Dichloroethane	2	2	Bromodichloromethane	1	1
Hexane	5	5	cis-1,3-Dichloropropene	1	1
Chloroprene	5	5	4-Methyl-2-pentanone	5	5
Acrylonitrile	5	5	Toluene	1	1
Vinyl acetate	10	10	trans-1,3-Dichloropropene	1	1
Ethyl acetate	5	5	Ethyl methacrylate	10	10
2,2-Dichloropropane	5	5	1,1,2-Trichloroethane	3	3
Cis-1,2-Dichloroethene	5	5	2-Hexanone	5	5
Bromochloromethane	5	5	Cyclohexanone	5	5

Table 10. REPORTING LIMITS (Continued)

Compound	Water	Soil	Compound	Water	Soil
	µg/l	µg/kg		µg/l	µg/kg
Tetrachloroethene	1	1	4-Chlorotoluene	5	5
1,3-Dichloropropane	5	5	1,3,5-Trimethylbenzene	5	5
Dibromchloromethane	5	5	tert-Butylbenzene	5	5
1,2-Dibromoethane	2	2	1,2,4 Trimethylbenzene	5	5
Chlorobenzene	2	2	sec-Butylbenzene	5	5
1,1,1,2-Tetrachloroethane	5	5	1,3-Dichlorobenzene	5	5
Ethylbenzene	1	1	p-Isopropyltoluene	5	5
M,p-Xylene	1	1	1,4-Dichlorobenzene	5	5
o-Xylene	1	1	1,2-Dichlorobenzene	5	5
Styrene	5	5	n-Butylbenzene	5	5
Bromoform	4	4	1,2-Dibromo-3-choropropane	10	10
Isopropylbenzene	2	2	1,2,4-Trichlorobenzene	5	5
Bromobenzene	5	5	Hexachlorobutadiene	5	5
1,1,2,2-Tetrachloroethane	2	2	Naphthalene	5	5
Trans-1,4-Dichloro-2-butene	5	5	1,2,3-Trichlorobenzene	5	5
1,2,3-Trichloropropane	5	5	Epichlorohydrin	100	100
n-Proplybenzene	5	5	3-Methyl-1-butanol	5	5
2-Chlorotoluene	5	5	Hexachloroethane	5	5
Ethanol	50	--	Methyl Acrylate	5	--
Benzyl Chloride	1	--			

Table 11. COMPOUNDS THAT MAY EXHIBIT CARRYOVER

Compound
1,2,4-Trichlorobenzene
Hexachlorobutadiene
Naphthalene
1,2,3-Trichlorobenzene

ACCUTEST LABORATORIES
Standard Operating Procedure

Lab Manager_____

QA Manager_____

Effective Date:_____

TEST NAME: METHOD 8270D, SEMIVOLATILE ORGANIC COMPOUNDS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (GC/MS)

REFERENCE: SW846 8270D (Revision 4, February 2007)

Revised Sections: ***2.1, 9.5.1, 10.1.1, 11.11.2, 12.6.2, 12.6.3, 12.8.3, Tables 7C, 9, 10***
Added Section 12.11

SCOPE AND APPLICATION

1.1 The following method describes the analytical procedure that is utilized by Accutest to analyze semivolatile organic compounds in extracts prepared from all types of solid waste matrices, soils, and water samples. Options are incorporated for the analysis of sixteen (16) polyaromatic hydrocarbons (PAH) and other compounds listed in table 8A by selected ion monitoring GC/MS (GC/MS-SIM).

1.2 Table 1 lists the neutral, acidic, and basic organic compounds that can be determined by this method. The applicable concentration range of this method is compound and instrument dependent. Some compounds may require special treatment due to the limitations caused by sample preparation and/or chromatographic problems.

2.0 SUMMARY OF METHOD

2.1 This method is performed in accordance with the following extraction methodologies in SW846: 3510, 3520, 3545, 3550 and 3580.

2.2 The resultant methylene chloride extract is injected into a tuned and calibrated GC/MS system equipped with a fused silica capillary column. The GC column is temperature-programmed to separate the analytes, which are then detected with a mass spectrometer (MS) connected to the gas chromatograph.

2.3 The peaks detected are qualitated by comparison to characteristic ions and retention times specific to the known target list of compounds.

2.4 Once identified, the compound is quantitated by internal standard techniques with an average response factor generated from the calibration curve.

2.5 Additional unknown peaks with a response greater than 10 % of the closest internal standard may be processed through a library search with comparison to a NIST98 database. An estimated concentration is quantitated by assuming a response factor of 1.

2.6 This method includes analytical options for PAHs and other selected compounds by GC/MS-SIM. The extract is fortified with an additional SIM specific internal standard mix and analyzed using selected ions that are characteristic of the compounds of interest following the analysis of lower concentration

calibration standards analyzed under the same MS scan conditions. Qualitative and quantitative identification is conducted using the procedures employed for full scan analysis.

3.0 REPORTING LIMIT & METHOD DETECTION LIMIT

3.1 Reporting Limit. The reporting limit for this method is established at either method detection limit or the lowest concentration standard in the calibration curve, depending on the requirements of different regulatory programs. Detected concentrations below this concentration cannot be reported without qualification. See table 9.

3.1.1 Compounds detected at concentrations between the reporting limit and MDL are quantitated and qualified as "J", estimated value. Program or project specifications may dictate that "J" qualified compounds are not to be reported.

3.2 Method Detection Limit. Experimentally determine MDLs using the procedure specified in 40 CFR, Part 136, Appendix B. This value represents the lowest reportable concentration of an individual compound that meets the method qualitative identification criteria.

3.2.1 Experimental MDLs must be determined annually for this method.

3.2.2 Process all raw data for the replicate analysis in each MDL study. Forward the processed data to the QA group for archiving.

4.0 DEFINITIONS

BATCH - a group of samples which behave similarly with respect to the sampling or the testing procedures being employed and which are processed as a unit. For QC purposes, if the number of samples in a group is greater than 20, then each group of 20 samples or less will all be handled as a separate batch.

BLANK - an analytical sample designed to assess specific sources of laboratory contamination.

CONTINUING CALIBRATION - a mid-range calibration check standard run every 12 hours to verify the initial calibration of the system.

EXTRACTED ION CURRENT PROFILE (EICP) - a plot of ion abundance versus time (or scan number) for ion(s) of specified mass (Es).

INITIAL CALIBRATION - analysis of analytical standards for a series of different specified concentrations which cover the working range of the instrument; used to define the linearity and dynamic range of the response of the mass spectrometer to the target compounds.

INTERNAL STANDARDS - compounds added to every standard, blank, matrix spike, matrix spike duplicate, and sample extract at a known concentration, prior to analysis. Internal standards are used as the basis for quantitation of the target compounds and must be analytes that are not sample components.

MATRIX - the predominant material of which the sample to be analyzed is composed.

MATRIX SPIKE - aliquot of a matrix (water or soil) fortified (spiked) with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery.

MATRIX SPIKE DUPLICATE - a second aliquot of the same matrix as the matrix spike (above) that is spiked in order to determine the precision of the method.

METHOD BLANK - an analytical control consisting of all reagents, internal standards and surrogate standards, is carried throughout the entire preparatory and analytical procedure. The method blank is used to define the level of laboratory, background and reagent contamination.

METHOD DETECTION LIMITS (MDLs) - The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. MDLs should be determined approximately once per year for frequently analyzed parameters.

PERCENT DIFFERENCE (%D) - As used to compare two values, the percent difference indicates both the direction and the magnitude of the comparison, i.e., the percent difference may be either negative, positive, or zero. (In contrast, see relative percent difference.)

PRIMARY QUANTITATION ION - a contract specified ion used to quantitate a target analyte.

REAGENT WATER - water in which no interferant is observed at or above the minimum detection limit of the parameters of interest.

RECONSTRUCTED ION CHROMATOGRAM (RIC) - a mass spectral graphical representation of the separation achieved by a gas chromatograph; a plot of total ion current versus retention time.

RELATIVE PERCENT DIFFERENCE (RPD) - As used to compare two values, the relative percent difference is based on the mean of the two values, and is reported as an absolute value, i.e., always expressed as a positive number or zero. (In contrast, see percent difference.)

RELATIVE RESPONSE FACTOR (RRF) - a measure of the relative mass spectral response of an analyte compared to its internal standard. Relative Response Factors are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples.

RELATIVE RETENTION TIME (RRT) - the ratio of the retention time of a compound to that of a standard (such as an internal standard).

RESOLUTION - also termed separation or percent resolution, the separation between peaks on a chromatogram, calculated by dividing the depth of the valley between the peaks by the peak height of the smaller peak being resolved, multiplied by 100.

INITIAL CALIBRATUION VERIFICATION (SECOND SOURCE CALIBRATION STANDARD) - a standard from a separate source than the calibration curve that is used to verify the accuracy of the calibration standards. An external check must be run whenever an initial calibration is performed.

SURROGATES - pure analytes added to every blank, sample, matrix spike, matrix spike duplicate, and standard in known amounts before extraction or other processing; used to evaluate analytical efficiency

by measuring recovery. Surrogates are brominated, fluorinated, or isotopically labeled compounds not expected to be detected in environmental media.

5.0 HEALTH & SAFETY

5.1 The analyst must follow normal safety procedures as outlined in the Accutest Health and Safety Plan and Personal Protection Policy, which include the use of safety glasses and lab coats. In addition, all acids are corrosive and must be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical must be treated as a potential health hazard. Exposure to these reagents must be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets is made available to all personnel involved in these analyses.

5.3 The following analytes covered by this method have been tentatively classified as known or suspected human or mammalian carcinogens: benzo(a)anthracene, benzidine, 3,3'-dichlorobenzidine, benzo(a)pyrene, dibenzo(a,h)anthracene, N-nitrosodimethylamine, and 4,4'-DDT. Prepare primary standards of these toxic compounds in a hood. A NIOSH/Mass approved toxic gas respirator must be worn when the analyst handles high concentrations of these toxic compounds.

6.0 INTERFERENCES

6.1 The data from all blanks, samples, and spikes must be evaluated for interferences.

6.2 Method interferences may be caused by contaminants in solvents, reagents, glassware, and other stages of sample processing. Refer to "The Preparation of Glassware for Extraction of organic contaminants" SOP for practices utilized in the extraction department.

6.3 Matrix interferences may be caused by contaminants that are co-extracted from the sample. The extent of matrix interferences will vary considerably from source to source, depending upon the nature and diversity of the industrial complex or municipality being sampled.

6.4 To reduce carryover when high-concentration samples are sequentially analyzed, the syringe must be rinsed out between samples with solvent. Whenever an unusually concentrated sample is encountered, it should be followed by the analysis of solvent to check for cross contamination.

7.0 SAMPLE COLLECTION, PRESERVATION, & HOLDING TIMES

7.1 Water samples may be collected in 1-liter glass bottles with Teflon insert in caps. Soil samples may be collected in 250-ml wide-mouth amber glass bottles.

7.1.1 Sample should be taken with care so as to prevent any portion of the collected sample coming in contact with the sampler's gloves, thus avoiding possible phthalate contamination.

7.2 Test all aqueous samples for residual chlorine using test paper for free and total chlorine. If the sample tests positive for residual chlorine, add 80 mg of sodium thiosulfate to each liter of sample.

7.3 The samples must be protected from light and refrigerated at $\leq$ 6° C from the time of receipt until extraction and analysis.

7.4 Store the sample extracts at -10 °C in amber vials (protected from light), in sealed vials equipped with unpierced PTFE-lined septa.

7.5 HOLDING TIME

7.5.1 Aqueous samples must be extracted within 7 days of sampling.

7.5.2 Soil, sediments and concentrated waste samples must be extracted within 14 days of sampling.

7.5.3 Extracts must be analyzed within 40 days following extraction.

8.0 APPARATUS & MATERIALS

8.1 GAS CHROMATOGRAPH/MASS SPECTROMETER SYSTEM

8.1.1 Gas Chromatograph. HP-5890, HP-6890, or Agilent 6890-N which includes an analytical system that is complete with a temperature programmable gas chromatograph and all required accessories including syringes, capillary chromatographic columns, and gases.

8.1.1.1 The injection port is designed for splitless injection with capillary columns.

8.1.1.2 The capillary column is directly coupled to the source.

8.1.2 Column.

8.1.2.1 30 m x 0.25 mm fused silica (0.25 µm film thickness) DB-5MS or equivalent capillary column. Condition the column as per manufacture's directions.

8.1.3 Mass Spectrometer (HP-5972, HP-5973 or Agilent 5975).

8.1.3.1 Full Scan Mode -Capable of scanning from 35-500 amu every 1 second or less utilizing 70 volt (nominal) electron energy in the electron impact ionization mode.

8.1.3.2 SIM Mode- Capable of selective ion grouping at specified retention times for increased compound sensitivity (table 2a).

8.1.3.3 Capable of producing a mass spectrum which meets all the EPA performance criteria in Table 3 when injecting 50 ng of Decafluorotriphenyl phosphine (DFTPP).

8.2 DATA SYSTEM

8.2.1 Acquisition and Instrument Control: HP Chemstation. A computer system is interfaced to the mass spectrometer that allows the continuous acquisition and storage on machine readable

media (disc) of all mass spectra obtained throughout the duration of the chromatographic program.

8.2.2 Data Processing: HP Enviroquant. The software accommodates searching of GC/MS data files for analytes which display specific fragmentation patterns. The software also allows integrating the abundance of an EICP between specified time or scan number limits. The data system includes the NIST98 spectra library for qualitative searches of non-target compounds present in the chromatogram. It flags all data files that have been edited manually by laboratory personnel.

8.2.3 Offline Magnetic Tape Storage Device (Lagato Networker) - the magnetic tape storage device copies data for long term, offline storage.

8.3 SYRINGE

8.3.1 10 µl graduated, auto sampler (Hamilton or equiv.).

8.3.2 Micro liter syringes, various sizes

9.0 REAGENTS AND STANDARDS

9.1 Solvents - Ultra pure, chromatography grade methylene chloride and acetone.

9.2 Stock Standard Solutions.

9.2.1 Certified, commercially prepared standards, from two separate sources are used.

9.2.1.1 Base Neutrals.

- Base/Neutrals Mix #1 (Absolute: Semivolatile Organics Standard Mix # 1).
- Base/Neutrals Mix #2 (Absolute: Semivolatile Organics Standard Mix # 2).
- PAH Mix (Absolute: Semivolatile Organics Standard Mix # 7).
- PAH Mixture #2 (Ultra).
- PAH Selected Ion Monitoring Mixture
- Benzidines Mix (Absolute: Semivolatile Organics Standard Mix # 6).
- Toxic Substances #2 (Absolute: Semivolatile Organics Standard Mix # 5).
- Pyridines Mixture (Ultra).
- Additonal requested compound(s) mix (Absolute).
- Base Neutral Mixture (2nd Source).

Acids.

- Phenols Mix (Absolute: Semivolatile Organics Standard Mix # 8).
- Toxic Substances #1(Absolute: Semivolatile Organics Standard Mix # 4).
- Acid Mixture (2nd Source).Internal Standard Mixtures.

9.2.2 Internal Standard Mixtures

9.2.2.1 Ultra (or equivalent) at a concentration of 4,000 µg/ml for each of the following compounds.

Full Scan
- 1,4-Dichlorobenzene-d4
- Naphthalene-d8
- Acenaphthene-d10
- Phenanthrene-d10
- Chrysene-d12
- Perylene-d12

SIM
- 1,2-Dichlorobenzene-d4
- 1-Methylnaphthalene-d10
- Fluorene-d10
- Fluoranthene-d10
- Benzo(a)pyrene-d12

9.2.2.2 The internal standards should permit most of the components of interest in a chromatogram to have retention times of 0.8 - 1.20 relative to one of the internal standards.

9.2.2.3 Each 1 ml sample extract, and standard undergoing analysis should be spiked with 10 µl of the internal standard mixtures, resulting in a concentration of 40 µg/ml of each internal standard for full scan analysis and 4 ug/ml for SIM analysis.

9.2.3 Surrogate Standard Mixture.

9.2.3.1 B/N Surrogate Standard Mix: RESTEK (or equivalent) at a concentration of 5,000 µg/ml each surrogate compound.

- Nitrobenzene-d5.
- 2-Fluorobiphenyl.
- p-Terphenyl-d14.

9.2.3.2 Acid Surrogate Standard Mix: RESTEK (or equivalent) at a concentration of 7,500 µg/ml each surrogate compound.

- Phenol-d5.
- 2-Fluorophenol.
- 2,4,6-Tribromophenol.

9.2.4 DFTPP Tune Stock.

9.2.4.1 Protocol (or equivalent) at a concentration of 2,500 µg/ml for the following compounds.

- Decafluorotriphenylphosphine.
- 4,4'-DDT.

- Benzidine.
- Pentachlorophenol.

9.2.5 Store at -10 °C or less when not in use or according to the manufacturer's documented holding time and storage temperature recommendations. Stock standard solutions must be replaced after 1 year or sooner if manufacture's expiration date comes first or comparison with quality control check samples indicates degradation.

9.3 Surrogate Spiking Solutions.

9.3.1 Two surrogate spiking solutions, base/neutral surrogate solution and acid surrogate solution, at a concentration of 100 µg/ml are prepared in Extraction. Spike each sample, and blank with 0.5 ml of each solution, prior to extraction, for a final concentration of 50 µg/l of each surrogate compound in the extract.

9.3.2 A calibration range must be constructed for the surrogate compounds. Accordingly, appropriate amounts of surrogates are mixed with each calibration solution to define a range similar to the target compounds.

9.3.3 Store at -10 °C or less or according to the manufacturer's documented storage temperature recommendations. Prepare fresh surrogate spiking solutions every year, or sooner, if the manufacturer's expiration dates come first or if the solution has degraded or evaporated.

9.4 Intermediate Calibration Standard Solution.

9.4.1 The calibration stock solution is prepared by adding an appropriate amount of each stock and surrogate compounds into a 10 ml volumetric flask. Dilute the solution to the volume with methylene chloride and mix thoroughly. Refer to Table 7A for details.

9.5 Calibration Standards.

9.5.1 Initial Calibration Standards.

9.5.1.1 Calibration standards containing the surrogate compounds should be made by quantitative dilutions of the above intermediate solution. The calibration standards are prepared at a minimum of five concentrations to cover the range of 1 - 100 µg/ml for full scan and 0.02 – 5ug/ml for SIM, depending upon project specific requirements. Suggested levels and preparations are shown in Table 7A and 7B.

9.5.2 Continuing Calibration Verification.

9.5.2.1 The concentration of the mid range standard used for continuing calibration verification is altemated between 25 and 50 µg/ml for full scan and 2.5 and 1.0 for SIM.

9.5.3 Store the calibration standards in a refrigerator at $\leq$ 6 °C and prepare every 6 months or before the manufacturer's expiration date, whichever is sooner. Standards must be replaced immediately if the analysis of check standards indicates degradation.

9.6 Initial Calibration verification (ICV) -Second source calibration check standard.

9.6.1 The ICV standard is prepared per Table 7E, using the intermediate solutions prepared in Extraction.

9.6.2 The ICV is analyzed after each initial calibration.

9.7 Daily GC/MS Performance Checks.

9.7.1 The solution is prepared at 50 µg/ml by making a 1:50 dilution of DFTPP stock solution (Section 9.2.4) in methylene chloride.

9.8 Matrix Spike Solutions.

9.8.1 The matrix spike solutions for both Base/Neutral and Acid are prepared in Acetone at a concentration of 100 µg/ml for each compound. Prepare the matrix spike, matrix spike duplicate and blank spike by spiking the selected sample and the blank with 0.5 ml of these solutions for a final concentration of 50 µg/l of each compound.

9.9 All organic new standard solutions are analyzed prior to use to verify the accuracy of the prepared concentration.

9.9.1 The prepared standard solution is analyzed using the determinative (instrumental) technique for the method.

9.9.2 The solution is analyzed following the completion of instrument calibration or a calibration check.

9.9.3 The concentration of the standard solution is determined using the software routines used in determining the acceptability of calibration verification.

9.9.4 The data is evaluated and the percent difference determined. The standard solution is approved for use if all designated compounds are present in the solution and the percent difference is less than the established criteria (±20%).

10.0 CALIBRATION

10.1 Initial Calibration.

10.1.1 The calibration range covered for routine analysis under RCRA employs standards of 1, 2, 5, 10, 25, 50, 80, 100 µg/ml for full scan and 0.02, 0.05, 0.10, 0.20, 1.0, 2.5, 5.0 ug/ml for SIM. A minimum of five standards must be run sequentially. The reporting limit is established by the concentration of the lowest standard analyzed during the initial calibration. Lower concentration standard may be needed to meet the reporting limit requirements of state specific regulatory program. The linear range covered by this calibration is the highest concentration standard.

10.1.2 A calibration range must be constructed for each surrogate compound. Accordingly, add appropriate amounts of surrogate spiking solutions to the calibration solution to define a range similar to the target compounds.

10.1.3 Aliquot 1 ml of each calibration standard into a 2 ml crimp top vial.

10.1.4 Prior to analysis, add 10 µl of the applicable (Full scan and/or SIM) internal standard solution (Section 9.2.2) to each standard. This results in a concentration of 40 µg/ml (Full scan) and 4ug/ml (SIM) for each internal standard.

10.1.5 Analyze the standard solutions using the conditions established in Section 11.0. Each analyte is quantitatively determined by internal standard technique using the closest eluting internal standard and the corresponding area of the major ion. See Table 6.

10.1.6 The Response Factor (RF) is defined in Section 13.1. Calculate the mean RF for each target analyte, using minimum of five RF values calculated from the initial calibration curve.

10.1.7 For the initial calibration to be valid, the following criteria must be met.

10.1.7.1 The percent relative standard deviation (% RSD) (see Section 13.2) of all target analytes must be less than or equal to 20%.

10.1.7.2 If the %RSD of any individual compound is ≥20%, employ an alternative calibration linearity model. Specifically, linear regression using a least squares approach may be employed.

10.1.7.2.1 If a linear regression is employed, select the linear regression calibration option of the mass spectrometer data system. Do not force the regression line through the origin and do not employ 0,0 as a sixth calibration standard.

10.1.7.2.2 The correlation coefficient (r value) must be ≥0.99 for each compound to be acceptable.

10.1.7.2.2.1 When calculating the calibration curves using the linear regression model, a minimum quantitation check on the viability of the lowest calibration point should be performed by re-fitting the response from the low concentration calibration standard back into the curve.

10.1.7.2.2.2 The recalculated concentration of the low calibration point should be within ± 30% of the standard's true concentration.

10.1.7.2.3 If more than 10% of the compounds included with the initial calibration exceed the 20% RSD limit and do not meet the minimum correlation coefficient for the linear calibration option, then the chromatographic system is considered too reactive for the analysis to begin. Perform

corrective action and recalibrate if the calibration criteria cannot be achieved.

10.1.7.3 It is recommended that the minimum response factor for the most common target analytes in the following table should be demonstrated for each individual calibration level as a means to ensure that these compounds are behaving as expected.

Minimum Response Factor Table

Semivolatile Compounds	Minimum Response Factor (RF)
Benzaldehyde	0.010
Phenol	0.800
Bis (2-chloroethyl) ether	0.700
2-Chlorophenol	0.800
2-Methylphenol	0.700
2,2'-Oxybis-(1-chloropropane)	0.010
Acetophenone	0.010
4-Methylphenol	0.600
N-Nitroso-di-n-propylamine	0.500
Hexachloroethane	0.300
Nitrobenzene	0.200
Isophorone	0.400
2-Nitrophenol	0.100
2,4-Dimethylphenol	0.200
Bis(2-chloroethoxyl)methane	0.300
2,4-Dichlorophenol	0.200
Naphthalene	0.700
4-Chloroaniline	0.010
Hexachlorobutadiene	0.010
Caprolactam	0.010
4-Chloro-3-methylphenol	0.200
2-Methylnaphthalene	0.400
Hexachlorocyclopentadiene	0.050
2,4,6-Trichlorophenol	0.200
2,4,5-Trichlorophenol	0.200
1,1'-Biphenyl	0.010
2-Chloronaphthalene	0.800
2-Nitroaniline	0.010
Dimethyl phthalate	0.010
2,6-Dinitrotoluene	0.200
Acenaphthylene	0.900
3-Nitroaniline	0.010
Acenaphthene	0.900
2,4-Dinitrophenol	0.010
4-Nitrophenol	0.010
Dibenzofuran	0.800
2,4-Dinitrobenzene	0.200

Diethyl phthalate	0.010
1,2,4,5-Tetrachlorobenzene	0.010
4-Chlorophenyl-phenyl ether	0.400
Fluorene	0.900
4-Nitroaniline	0.010
4,6-Dinitro-2-methylphenol	0.010
4-Bromophenyl-phenyl ether	0.100
N-Nitrosodiphenylamine	0.010
Hexachlorobenzene	0.100
Atrazine	0.010
Pentachlorophenol	0.050
Phenanthrene	0.700
Anthracene	0.700
Carbazole	0.010
Di-n-butyl phthalate	0.010
Fluoranthene	0.600
Pyrene	0.600
Butyl benzyl phthalate	0.010
3,3'-Dichlorobenzidine	0.010
Benzo(a)anthracene	0.800
Chrysene	0.700
Bis-(2-ethylhexyl)phthalate	0.010
Di-n-octyl phthalate	0.010
Benzo(b)fluoranthene	0.700
Benzo(k)fluoranthene	0.700
Benzo(a)pyrene	0.700
Indeno(1,2,3-cd)pyrene	0.500
Dibenz(a,h)anthracene	0.400
Benzo(g,h,i)perylene	0.500
2,3,4,6-Tetrachlorophenol	0.010

10.1.7.3.1 Due to the large number of compounds, some compounds will fail to meet the minimum response factor criteria. They may be used as qualified data or estimated values for screening purposes. Non-detects may be reported if adequate sensitivity has been demonstrated at the applicable lower quantitation limit.

10.1.7.4 The initial calibration criteria for this method applies to all additional compounds of concern specified by the client.

10.1.7.5 The relative retention times of each target analyte in each calibration standard should agree within 0.06 relative retention time units.

10.2 Initial Calibration Verification (ICV) - Source Calibration Check Standard.

10.2.1 The calibration is verified with a calibration check standard at 50 µg/ml (Full scan) or 1ug/ml (SIM) from an external source (Section 9.6). It must be analyzed immediately following the initial calibration.

10.2.2 The percent difference (% D) (Section 13.3) for this standard must meet the criteria of 30% for all the target compounds.

10.2.2.1 If % D is greater than 30%, reanalyze the second source check. If the criteria cannot be met upon re-injection, re-prepare the second source solution using a fresh ampoule and repeat the process.

10.2.2.2 If the %D criteria cannot be achieved after re-preparation of the second source, prepare a third source and repeat the process. Make fresh calibration standards using one of the two standard sources that match each other.

10.3 Continuing Calibration Verification Standard - CCV

10.3.1 A calibration verification standard at close mid-level concentration of the initial calibration range at alternating 25 and 50ug/ml for full scan and 2.5ug/ml and 1ug/ml for SIM must be acquired every 12 hrs.

10.3.1.1 The calibration verification standard selected must be near concentration of the midpoint calibration standard or near the action level for the project specified.

10.3.2 For the continuing calibration to be valid, all of the following specified criteria must be met.

10.3.2.1 Each of the most common target analytes in the calibration verification standard should meet the minimum response factors as noted in the Minimum Response Factor Table in section 10.1.7.3.

10.3.2.2 All target compounds of interest must be evaluated using a 20% D criteria. If the percent difference or percent drift for a compound is less than or equal to 20%, then the initial calibration for that compound is assumed to be valid.

10.3.2.3 Due to the large numbers of compounds that may be analyzed by this method, it is expected that some compounds will fail to meet the 20% D criterion. If the criterion is not met (i.e., greater than 20% difference or drift) for more than 20% of the compounds included in the initial calibration, then corrective action must be taken prior to the analysis of samples.

10.3.2.4 In cases where compounds fail, they may still be reported as non-detects if it can be demonstrated that there was adequate sensitivity to the compound at the applicable quantitation limits. For situation when the failed compound is present, the concentrations must be reported as estimated.

10.3.3 If the first continuing calibration verification does not meet criteria, a second standard may be injected after notifying the team leader/manager and checking the system for defects.

10.3.3.1 A continuing calibration check is allowed to be repeated only once; if the second trial fails, a new initial calibration must be performed or refer to section 10.3.2.4. In situations where the first check fails to meet the criteria, the instrument logbook should have clear documented notations as to what the problem was and what corrective action was implemented to enable the second check to pass.

10.3.4 If the verification criteria cannot be achieved, a new initial calibration must be performed or refer to section 10.3.2.4.

10.3.5 If any of the internal standard areas change by a factor of two (- 50% to + 100%) or the retention time changes by more than 30 seconds from the midpoint standard of the last initial calibration, the mass spectrometer must be inspected for malfunctions and corrections must be made, as appropriate.

10.3.5.1 Reanalyze the continuing calibration standard. New initial calibration is required if reanalyzed standard continues to fail the internal standard requirements.

10.3.5.2 All samples analyzed while the system was out of control must be reanalyzed following corrective action.

11.0 PROCEDURE

11.1 Instrument Conditions.

11.1.1 Recommended instrument conditions are listed in Table 2 and 2a (SIM only). Modifications of parameters specified with an asterisk are allowed as long as criteria of calibration are met. Any modification should be approved by team leader/manger.

11.2 Daily GC/MS Performance Checks.

11.2.1 Mass Spectrometer Tuning. Every 12-hour, inject 1 µl of 50 ng/µl or 2 µl of 25 ng/µl DFTPP solution directly on to the column.

11.2.2 The GC/MS system must be checked to verify that acceptable performance criteria are achieved (see Table 3).

11.2.3 This performance test must be passed before any sample extracts, blanks or standards are analyzed. Evaluate the tune spectrum using three mass scans from the chromatographic peak and a subtraction of instrument background.

11.2.3.1 Select the scans at the peak apex and one to each side of the apex.

11.2.3.2 Calculate an average of the mass abundances from the three scans.

11.2.3.3 Background subtraction is required. Select a single scan in the chromatogram that is absent of any interfering compound peak and acquired within no more than 20 scans to the elution of DFTPP. The background subtraction should be designed only to eliminate column bleed or instrument background ions. Do not subtract part of the tuning compound peak.

11.2.4 If all the criteria are not achieved, the analyst must retune the mass spectrometer with team leader/manager and repeat the test until all criteria are met.

11.2.4.1 Alternatively, an additional scan on each side of the peak apex may be selected and included in the averaging of the mass scans. This will provide a mass spectrum of

five averaged scans centered on the peak apex. NOTE: The selection of additional mass scans for tuning may only be performed with supervisory approval on a case by case basis.

11.2.5 The injection time of the acceptable tune analysis is considered the start of the 12-hour clock.

11.2.6 In order to assess GC column performance and injection port inertness, the DFTPP tune standard also contains appropriate amount of 4,4'-DDT, benzidine and pentachlorophenol.

11.2.6.1 Injection Port Inertness Check.

11.2.6.1.1 The injection port inertness of the GC portion of the GC/MS is evaluated by the percent breakdown of 4,4'-DDT. DDT is easily degraded in the injection port. Breakdown occurs when the injection port liner is contaminated by high boiling residue from sample injection or when the injector contains metal fittings. Check for degradation problems by injecting a GC/MS tune standard containing 4,4'-DDT every 12 hour, regardless of whether DDT is a target analyte. The degradation of DDT to DDE and DDD should not exceed 20%, in order to proceed with calibration procedures. Refer to Section 13.7 for calculation. Print the check and keep it on file.

11.2.6.2 Column Performance Check.

11.2.6.2.1 The condition of the GC column is evaluated by the tailing of benzidine and pentachlorophenol every 12 hour. Benzidine and pentachlorophenol should be present at their normal responses, with no visible peak tailing, as demonstrated by the peak tailing factors. The tailing factor criteria for benzidine (base-neutral fraction) must be ≤ 2 and for pentachlorophenol (acid fraction) must be ≤ 2. Print the check daily and keep on file:

11.2.6.3 If degradation is excessive and/or poor chromatography is observed, the injector port may require cleaning. It may also be necessary to break off the first 6-12 in. of the capillary column.

11.3 Initial Calibration

11.3.1 Refer to Section 10.1.

11.4 Initial calibration Verification (ICV) - Second Source Calibration Check

11.4.1 This standard must at least be analyzed when initial calibration provided. Refer to Section 10.2.

11.5 Continuing Calibration Checks

11.5.1 Refer to Section 10.3.

11.6 Sample Analysis.

11.6.1 Allow the sample extract to warm to room temperature. Spike 10 µl of the appropriate internal standard mix (4,000 µg/ml for full scan and 400ug/ml for SIM) into 1 ml sample extract, just prior to analysis. This is equivalent to a concentration of 40 µg/ml (full scan) and 4ug/ml (SIM) of each internal standard.

11.6.2 Inject 1 µl aliquot of the sample extract into the GC/MS system. A splitless injection technology is used.

11.6.3 If the response for any ion of interest exceeds the working range of the GC/MS system, dilute a stored extract if available and reanalyze.

11.6.4 When the extracts are not being used for the analyses, store them at -10°C, protected from light, in sealed vials equipped with unpierced PTFE-lined septa.

11.7 Sample Dilution

11.7.1 Establish dilution of sample in order to fall within calibration range or to minimize the matrix interference.

- Utilize screen data (specific project only).
- Utilize acquired sample data.
- Utilize the history program or approval from client/project.
- Sample characteristics (appearance, odor).

11.7.2 If no lower dilution has been reported, the dilution factor chosen should keep the response of the largest peak for a target analyte in the upper half of the initial calibration range of the instrument.

11.7.3 Preparing Dilutions.

11.7.3.1 Prepare sample dilutions quantitatively. Dilute the sample extract with methylene chloride using logical volume to volume ratios, i.e., 1:5, 1:10, 1:50, etc. Large dilutions may require serial dilutions or the use of a Class A 10 ml volumetric flask.

11.7.3.2 Syringe dilutions. – Calibrated syringes are used to prepare dilutions. Add the appropriate amount of methylene chloride to a clean autosampler vial. Add the proper amount of sample using a calibrated syringe of the appropriate volume for the dilution. Add sufficient internal standard to maintain a concentration of 40ug/ml. Cap the vial and gently shake to disperse the sample through the solvent.

11.7.3.3 Volumetric Flask Dilutions – Large dilutions may require the use of a 10 ml Class A Volumetric flask.

11.8 Establishing Search Criteria for target compounds. Search criteria for each compound listed in the method must be entered into the method quantitation/identification file in the Enviroquant software package. This activity must be performed before attempting qualitative and quantitative analysis on any acquired data file. The search criteria are based on compound retention time and the characteristic ions from the reference mass spectrum. Characteristic ions are defined as the three

ions of greatest relative intensity, or any ions over 30% relative intensity, if less than three such ions occur in the reference spectrum. The number of secondary ions displayed for each compound search varies between compounds.

11.8.1 Select the primary ion for the target compound from the characteristic ions in Table 6. If multiple characteristic ions are listed, the first ion is the major (primary) ion. Enter this ion as the search ion. Enter the relative abundance of this ion (100% for base peak ions) and set the relative abundance window at ± 30%.

11.8.1.2 Alternate primary ions may be selected when interferences exist from ion abundance contribution from close eluting compounds.

11.8.2 Enter the remaining ions as secondary ions. Secondary ions are not be used to locate peaks within the search window, but are be used to support the qualitative identification of selected peaks. The number of secondary ions displayed for each compound search varies between compounds depending on the number of ions in the spectra >30% relative abundance.

11.8.3 Set the relative abundance windows for the secondary ions at ± 30%.

11.8.4 Establish the relative retention window for each compound. Because it is a relative retention window the same width window applies to all compounds on the quantitation list. The window must be established at a minimum of 0.06 relative retention time units.

11.9 Data Interpretation.

11.9.1 Executing Qualitative Searches. The target compounds shall be identified by analyst with competent knowledge in the interpretation of mass spectra by comparison of the sample mass spectrum to the mass spectrum of a standard of the suspected compound.

11.9.1.1 The search procedure will identify peaks within the search window using the primary ion only. Secondary ions and the relative retention are used to determine "the best match". If the best match contains secondary ions outside the relative abundance window, they will be flagged with a # sign.

11.9.2 Qualitative Identification. The qualitative identification of compounds determined by this method is based on retention time and on comparison of the sample mass spectrum, after background correction, with characteristic ions in a reference mass spectrum. Compounds are identified when the following criteria are met.

11.9.2.1 The intensities of the characteristic ions of a compound must maximize in the same scan or within one scan of each other.

11.9.2.2 The sample component must elute at the same relative retention time (RRT) as the daily standard. Criterion is the RRT of sample component must be within ± 0.06 RRT units of the standard.

11.9.2.3 The relative intensities of the characteristic ions agree within 30% of the relative intensities of these ions in the reference spectrum. (Example: For an ion with an

abundance of 50% in the reference spectrum, the corresponding abundance in a sample spectrum can range between 20% and 80%).

11.9.2.3.1 If a chromatographic peak exhibits a spectrum containing an ion with relative abundance outside the relative abundance window is selected for reporting, the analyst must annotate the spectra that the compound qualified based on his/her best judgement. This circumstance will most often occur from coeluting compounds with similar ions or background matrix interferences.

11.9.3 Quantitative Analysis.

11.9.3.1 Once a target compound has been identified, its concentration (Section 13.4) will be based on the integrated area of the quantitation ion, normally the base peak (Table 6). The compound is quantitated by internal standard technique with an average response factor generated from the initial calibration curve.

11.9.3.2 If the sample produces interference for the primary ion, use a secondary ion to quantitate. This may be characterized by an excessive background signal of the same ion, which distorts the peak shape beyond a definitive integration. Also interference could severely inhibit the response of the internal standard ion. The secondary ion must be used to generate a new response factor.

11.10 Library Search for Tentatively Identified Compounds.

11.10.1 If a library search is requested, the analyst should perform a forward library search of the NIST98 mass spectral library to tentatively identify 10 to 15 non-reported compounds (15 for base, 10 for acid, 25 for base/acid fraction).

11.10.2 Guidelines for making tentative identification are listed below.

11.10.2.1 These compounds should have a response greater than 10% of the nearest internal standard. The response is obtained from the integration for peak area of the Total Ion Chromatogram (TIC).

11.10.2.2 The search is to include a spectral printout of the 3 best library matches for a particular substance. The results are to be interpreted by analyst.

11.10.2.3 Molecular ions present in the reference spectrum should be present in the sample spectrum.

11.10.2.4 Relative intensities of major ions in the reference spectrum (ions > 10 % of the most abundant ion) should be present in the sample spectrum.

11.10.2.5 The relative intensities of the major ions should agree within ± 20 %. (Example: For an ion with an abundance of 50% in the standard spectrum, the corresponding sample ion abundance must between 30 and 70%).

11.10.2.6 Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of coeluting compounds.

11.10.2.7 Ions present in the reference spectrum but not in the sample spectrum should be verified by performing further manual background subtraction to eliminate the interference created by coeluting peaks and/or matrix interference.

11.10.3 Quantitation of the tentatively identified compounds is obtained from the total ion chromatogram based on a response factor of 1 and is to be tabulated on the library search summary data sheet.

11.10.4 The resulting concentration should be reported indicating: (1) that the value is estimate, and (2) which internal standard was used to determine concentration. Quantitation is performed on the nearest internal standard.

11.10.5 Peaks that are suspected to be aldol-condensation reaction products (i.e., 4-methyl-4-hydroxy-2-pentanone and 4-methyl-3-pentene-2-one) shall be searched and reported but not counted towards the total TIC count.

11.10.6 Any peak naming as "System artifact" (from the column bleedings) or "Internal Standard" (added by lab for other test, like SIM analysis) shall be searched and reported but not counted towards the total TIC count.

11.11 Selected Ion Monitoring (SIM) Option

NOTE: The use of SIM is not allowed by the SCDHEC for samples from South Carolina.

11.11.1 Instrument Set-Up: Modify the method for SIM analysis and define ion groups with retention times, ions and dwell times to include base peak ion for the target compounds of interest, surrogates, and internal standards (Table 2a, Table 8a) Select a mass dwell time of 50 milliseconds for all compounds.

11.11.2 Calibration: Calibrate the mass spectrometer in the selected ion monitoring mode using 7 calibration standards of 0.02, 0.05, 0.10, 0.20, 1.0, 2.5, 5.0 ug/ml. Spike each standard with the SIM specific internal standard solution at 4ug/ml. Calculate individual response factors and response factor RSDs using the procedures and criteria described in Section 10.1.6, 10.1.7.3 and 10.1.7.4.

11.11.3 Initial Calibration Verification. Verify the initial calibration after its completion using a 1.0 ug/ml calibration standard purchased or prepared from a second standards reference materials source. The initial calibration verification must meet the criteria of Section 10.2.2.

11.11.4 Continuing Calibration Verification. Verify the initial calibration every 12 hours using a 1.0 or 2.5 ug/ml calibration. The continuing calibration verification must meet the criteria of Section 10.3.

11.11.5 Sample Extract Analysis: Each extract has been previously spike with the SIM internal standard at 4 ug/ml. Analyze the sample extracts for the compounds of interest using the SIM scan parameters employed for the calibration standards.

11.11.6 Surrogate Standard Calculation.. Report surrogate spike accuracy for the surrogates spiked for the full scan GC/MS analysis at 50 ug/ml.

12.0 QUALITY CONTROL

12.1 QC Requirements Summary.

Daily GC/MS Performance Checks	Beginning of the analytical shift and every 12 hours
Initial Calibration	Whenever needed.
Second Source Calibration Check	Following initial calibration
Continuing Calibration Verification	Every 12 hours.
Method Blank	One per extraction batch*.
Blank Spike	One per extraction batch*.
Matrix Spike	One per extraction batch*.
Matrix Spike Duplicate	One per extraction batch*.
Surrogate	Every sample extract and standard.
Internal Standard	Every sample extract and standard.

*The maximum number of samples per batch is twenty or per project specification.

12.2 Daily GC/MS Performance Checks.

12.2.1 Refer to Section 11.2.

12.3 Initial Calibration.

12.3.1 Refer to Section 10.1.

12.4 Initial Calibration Verification (ICV) - Source Calibration Check.

12.4.1 Refer to Section 10.2.

12.5 Continuing Calibration Verification.

12.5.1 Refer to section 10.3.

12.6 Method blank.

12.6.1 The method blank is either reagent water or anhydrous sodium sulfate (depending on the sample matrix) which must be extracted with each set of 20 or less samples. For a running

batch, a new method blank is required for each different extraction day. The method blank is then extracted and carried through all stages of the sample preparation and measurement.

12.6.2 If the method blank contains a target analyte above its MDL , the entire batch must be re-extracted and re-analyzed.

12.6.3 Surrogate compounds are added to the method blank prior to extraction. If the surrogate accuracy in the method blank does not meet in house criteria , it must be reanalyzed. If the reanalysis confirms the original data, the entire batch should be re-extracted.

12.7 Blank Spike

12.7.1 A blank spike must be extracted with each set of 20 or less samples. For a running batch, a new blank spike is required for each different extraction day. The blank spike consists of an aliquot of a clean (control) matrix similar to the sample matrix and of the same volume. It is spiked with the same analytes at the same concentrations as the matrix spike/matrix spike duplicate.

12.7.2 The blank spike recoveries should be assessed using laboratory in house limits.

12.7.3 If a blank spike is out of control, the following corrective actions must be taken and all the associated samples must be re-extracted and reanalyzed. The exception is if the blank spike recovery is high and no hits reported in associated samples and QC batch. In that case, the sample results can be reported with footnote (remark) and no further action is required.

12.7.3.1 Check to be sure that there are no errors in the calculations, or spike solutions. If errors are found, recalculate the data accordingly.

12.7.3.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample batch.

12.7.3.3 If no problem is found, re-extract and reanalyze the sample batch.

12.8 Matrix Spike(MS) / Matrix Spike Duplicate(MSD)

12.8.1 One sample is randomly selected from each extraction batch and spiked in duplicate to assess the performance of the method as applied to a particular matrix and to provide information on the homogeneity of the matrix. Both the MS and MSD are carried through the complete sample preparation, and determinative procedures.

12.8.2 Matrix spikes are prepared by spiking an actual sample at a concentration of 50 µg/l for both base/neutral and acids.

12.8.3 Assess the matrix spike recoveries (% R) (Section 13.5) and relative percent difference (RPD) (Section 13.6) against the in house control limits.

12.8.4 If the matrix spike accuracy of any individual compound is out of control, the accuracy for the compound in the blank spike must be within control. In such case, matrix interference is assumed and the data is reported with footnote (e.g., spike recovery indicates possible matrix interference). No further corrective action is required.

12.9 Surrogates

12.9.1 All standards, blanks, sample extracts, and matrix spikes contain surrogate compounds which are used to monitor the performance of the extraction and analytical system.

12.9.2 The recoveries (Section 13.5) of the surrogates must be evaluated to determine whether or not they fall within surrogate control limits developed by the laboratory annually.

12.9.3 If the recovery of any surrogate compound does not meet the control limits, the calculation must be checked for possible error. The surrogate solution should be checked for degradation. Contamination and instrument performance should also be reviewed.

12.9.3.1 Reanalyze the extract if no calculation errors are detected. If the surrogate recoveries for the reanalyzed extract are in control, report the data from the reanalysis only.

12.9.3.2 If the data from the reanalysis is also out of control, re-extract and reanalyze the sample.

12.9.3.3 If, upon reanalysis, the surrogate recoveries are acceptable, report the reanalysis data. If the holding time has expired prior to the reanalysis, report both the original and reanalysis results and note the holding time problem.

12.9.3.4 If the recovery is again not within limits, the problem is considered to be matrix interference. Submit both data sets with the original analysis being reported.

12.9.4 If the sample exhibits matrix interference, defined as excessive signal where target or non-target responses are greater than the response of the internal standards. In this case, reanalysis may not be required following team leader/manager approval; the surrogates will be qualified as outside the limits due to matrix interference. Alternatively, sample may be reanalyzed on dilution, if the reanalysis is again not within the limit, the sample should be reported with a footnote indicating that there were possible matrix interference.

12.10 Internal Standards.

12.10.1 Retention time for all internal standards must be within ± 30 seconds of the corresponding internal standard in the latest continuing calibration or 50 µg/ml standard of initial calibration.

12.10.2 The area (Extracted Ion Current Profile) of the internal standard in all analyses must be within 50 to 200 % of the corresponding area of the latest calibration standard (12 hr. time period).

12.10.3 If the area of internal standard does not meet control limits, the calculations must be checked. If a problem is not discovered, the sample must be reanalyzed.

12.10.4 If the areas are acceptable upon reanalysis, the reanalysis data is reported.

12.10.5 If the areas are unacceptable upon reanalysis, then both sets of data are submitted with the original analysis reported.

12.11 Refer to Project Specific Bench Notes(MS8270) for additional program or client specific QC requirements

13.0 CALCULATION

13.1 Response Factor (RF).

$$RF = \frac{A_s \times C_{is}}{A_{is} \times C_s}$$

where:

A_s = Area of the characteristic ion for the compound being measured.
A_{is} = Area of the characteristic ion for the specific internal standard.
C_s = Concentration of the compound being measured (µg/ml).
C_{is} = Concentration of the specific internal standard (µg/ml).

13.2 Percent Relative Standard Deviation (%RSD).

$$\%RSD = \frac{SD}{RF_{av}} \times 100$$

where:

SD = Standard Deviation.
RF_{av} = Average response factor from initial calibration.

13.3 Percent Difference (%D).

$$\%D = \frac{|RF_{av} - RF_{cv}|}{RF_{av}} \times 100$$

where: RF_{cv} = Response factor from Calibration Verification Standard.

13.4 Concentration (Conc.).

13.4.1 <u>for water:</u>

$$\text{Conc. (µg/l)} = \frac{A_s \times C_{is} \times V_t \times D \times 1000}{A_{is} \times RF_{av} \times V_i}$$

13.4.2 for soil/sediment (on a dry weight basis):

$$\text{Conc. } (\mu g/kg) = \frac{A_s \times C_{is} \times V_f \times D \times 1000}{A_{is} \times RF_{av} \times W_s \times S}$$

where:

V_f = Final Volume of total extract (ml).
D = Secondary dilution factor.
V_i = Initial volume of water extracted (ml).
W_s = Weight of sample extracted (g).
S = (100 - % moisture in sample) / 100.

13.5 Percent Recovery (%R).

$$\%\ R = \frac{\text{Concentration found}}{\text{Concentration spiked}} \times 100$$

13.6 Relative Percent Difference (RPD).

$$RPD = \frac{|MSC - MSDC|}{(1/2)(MSC+MSDC)} \times 100$$

where:

MSC = Matrix Spike Concentration.
MSDC = Matrix Spike Duplicate Concentration.

13.7 Percent Breakdown.

$$\%\ \text{Breakdown for DDT} = \frac{\text{Total DDT degradation peak area}}{\text{Total DDT peak area}} \times 100$$

where:

Total DDT degradation peak area = DDE + DDD
Total DDT peak area = DDT + DDE + DDD.

13.8 Linear regression by the internal standard technique.

$$C_s = \left(\frac{\frac{A_s}{A_{is}} - b}{a} \right) \times C_{is}$$

Where:
Cs = concentration of target analyte
As = Area of target analyte
Cis = concentration of the internal standard

b = Intercept
a = slope of the line

$$a = \frac{N \Sigma xy - \Sigma x \Sigma y}{N \Sigma x^2 - (\Sigma x)^2}$$

$$b = \frac{\Sigma y - a \Sigma x}{N}$$

N = number of points
x = amount of analyte
y = response of instrument

13.9 Correlation Coefficient

$$r = \frac{\Sigma(x - \bar{x})(y - \bar{y})}{\sqrt{\Sigma(x - \bar{x})^2 \Sigma(y - \bar{y})^2}}$$

Where r = correlation coefficient
x = amount of analyte
y = response of instrument

$\bar{x}$ = average of x values

$\bar{y}$ = average of y values

14.0 DOCUMENTATION

14.1 The Analytical Logbook is a record of the analysis sequence; the logbook must be completed daily. Each instrument will have a separate logbook.

14.1.1 If samples require reanalysis, a brief explanation of the reason must be documented in this log.

14.2 The Standard Preparation Logbook must be completed for all standard preparations. All information requested must be completed, the page must be signed and dated by the respective person.

14.2.1 The Accutest Lot Number must be cross-referenced on the standard vial.

14.3 The Instrument Maintenance Logbook must be completed when any type of maintenance is performed on the instrument. Each instrument has a separate log.

14.4 Any corrections to laboratory data must be done using a single line through the error. The initials of the person and date of correction must appear next to the correction.

14.5 Unused blocks of any form must be X'ed and Z'ed by the analyst before submitting the data for review.

14.6 Supervisory (or peer) personnel must routinely review (at least once per month) all laboratory logbooks to ensure that information is being recorded properly. Additionally, the maintenance of the logbooks and the accuracy of the recorded information should also be verified during this review.

15.0 DATA REVIEW AND REPORTING

15.1 Initial and continuing calibration check. Verify that all calibration and continuing calibration criteria have been achieved. If the criteria had not been achieved, corrective action must be performed to bring the system in control before analyzing any samples.

15.1.1 If samples had been analyzed under non-compliant calibration criteria, all sample extracts must be re-analyzed once the system is brought into control.

15.2 Quality Control Data Review. Review all QC data. If QC criteria were not achieved, perform corrective action before proceeding with analysis.

15.2.1 In some situation, corrective action may demand that the entire sample batch be re-extracted and re-analyzed before processing data.

15.3 Chromatogram Review. The chromatogram of each sample is evaluated for target analytes.

15.3.1 Each sample may require the reporting of different target analytes. Review the login to assure that the correct target compounds are identified.

15.3.2 Manual integration of chromatographic peaks must be identified by the analysts. Upon review, the supervisor will initial and date the changes made to the report.

15.4 Transfer to LIMS. Following the initial screen review, transfer the processed data to the LIMS.

15.4.1 Compare the printed values to the original values to verify transfer accuracy.

15.4.2 If transfer errors occurred, the errors must be corrected before the data is re-submitted.

16.0 POLLUTION PREVENTION & WASTE MANAGEMENT

16.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 16.2.

16.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, EHS004. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:

16.2.1 Non hazardous aqueous wastes.

16.2.2 Hazardous aqueous wastes
16.2.3 Chlorinated organic solvents
16.2.4 Non-chlorinated organic solvents
16.2.5 Hazardous solid wastes
16.2.6 Non-hazardous solid wastes

Table 1 – Target Compounds by SW846 8270C

Benzenethiol (1)	4-Bromophenyl phenyl ether	Di-n-octyl phthalate	5-Nitro-o-toluidine (1)
Benzoic Acid	Butyl benzyl phthalate	Diethyl phthalate	Naphthalene
2-Chlorophenol	Benzyl Alcohol	Dimethyl phthalate	Nitrobenzene
4-Chloro-3-methyl phenol	1,1'-Biphenyl (1)	2,3-Dichloroaniline (1)	n-Nitrosodimethylamine
2,4-Dichlorophenol	Butyl Stearate (1)	Decane	4-Nitroquinoline 1-Oxide (1)
2,4-Dimethylphenol	2-Chloronaphthalene	Octadecane (1)	N-Nitroso-di-n-propylamine
2,4-Dinitrophenol	4-Chloroaniline	bis(2-Ethylhexyl)phthalate	N-Nitrosodi-n-butylamine
2,6-Dichlorophenol	Carbazole	Ethyl methanesulfonate	N-Nitrosodiethylamine
4,6-Dinitro-2-methylphenol	Caprolactam (1)	Famphur	N-Nitrosodiphenylamine
Dinoseb	Chlorobenzilate	Fluoranthene	N-Nitrosomethylethylamine
2-Methylphenol	Chrysene	Fluorene	N-Nitrosomorpholine
3&4-Methylphenol	Cumene (1)	Hexachlorobenzene	N-Nitrosopiperidine
2-Nitrophenol	bis(2-Chloroethoxy)methane	Hexachlorobutadiene	N-Nitrosopyrrolidine
4-Nitrophenol	bis(2-Chloroethyl)ether	Hexachlorocyclopentadiene	O,O,O-Triethyl phosphorothioat
Pentachlorophenol	bis(2-Chloroisopropyl)ether	Hexachloroethane	2-Picoline
Phenol	4-Chlorophenyl phenyl ether	Hexachlorophene	Parathion
2,3,4,6-Tetrachlorophenol	1,2-Dichlorobenzene	Hexachloropropene	Pentachloroethane (1)
2,4,5-Trichlorophenol	1,2-Diphenylhydrazine	Indene (1)	Pentachlorobenzene
2,4,6-Trichlorophenol	1,3-Dichlorobenzene	Indeno(1,2,3-cd)pyrene	Pentachloronitrobenzene
2-Acetylaminofluorene	1,4-Dichlorobenzene	Isodrin	Phenacetin
4-Aminobiphenyl	2,4-Dinitrotoluene	Isophorone	Phenanthrene
Acenaphthene	2,6-Dinitrotoluene	Isosafrole	Phorate
Acenaphthylene	3,3'-Dichlorobenzidine	Kepone	Pronamide
Acetophenone	3,3'-Dimethylbenzidine	1-Methylnaphthalene	Pyrene
Aniline	1,4-Dioxane (1)	2-Methylnaphthalene	Pyridine
Anthracene	7,12-Dimethylbenz(a)anthracene	3-Methylcholanthrene	p-Phenylenediamine
Aramite	Dimethylnaphthalenes (total) (1)	4,4'-Methylenebis(2-chloroaniline)	Quinoline (1)
Atrazine (1)	Diallate	Methapyrilene	Safrole
alpha-Terpineol	Dibenz(a,h)acridine	Methyl methanesulfonate	1,2,4,5-Tetrachlorobenzene
A,A-Dimethylphenethylamine	Dibenzo(a,h)anthracene	Methyl parathion (1)	1,2,4-Trichlorobenzene
Benzidine	Dibenzofuran	6-Methyl Chrysene (1)	1,2,3-Trichlorobenzene (1)
Benzaldehyde (1)	Dimethoate	1,4-Naphthoquinone	1,3,5-Trichlorobenzene (1)
Benzo(a)anthracene	Diphenylamine	1-Naphthylamine	Thionazin (1)

Benzo(a)pyrene	Disulfoton	2-Naphthylamine	o-Toluidine
Benzo(b)fluoranthene	m-Dinitrobenzene	2-Nitroaniline	sym-Trinitrobenzene (1)
Benzo(g,h,i)perylene	p-(Dimethylamine) azobenzene (1)	3-Nitroaniline	Tetraethyl dithiopyrophosphate (1)
Benzo(k)fluoranthene	Di-n-butyl phthalate	4-Nitroaniline	

(1) NELAC Accreditation is not offered for this compound.

Table 2 – RECOMMENDED OPERATING CONDITIONS: Gas Chromatograph/ Mass Spectrometer	
Injection Type	Splitless
Carrier Gas (linear velocity)	Helium at 30 cm/sec*
Mass range	35-500 AMU
Electron Energy	70 volts (nominal)
Scan time	not to exceed 1 sec. per scan
Injection port temperature	200-300 °C
Source temperature	220-270 °C
Transfer line temperature	250-300 °C
Analyzer temperature	220-250 °C
Gas Chromatograph Temperature Program*	
Initial temperature	40-50 °C*
Time 1	2-4 minutes*
Column temperature rate	8-25 degrees/min*
Final temperature	290-320 °C according to column type*
Total run time	*20-40 minutes*

* Parameter modification allowed for performance optimization as long as QC criteria are achieved.

Table 2a – SIM Group Parameters		
Group No.	**Retention Time (minutes)**	**Ions**
1	0 – 7.8	150, 64, 93, 82, 152, 99, 63, 128, 112, 42, 95
2	7.8 – 11	150, 128, 225, 142, 172, 152, 129, 223, 141, 171, 122, 127, 227, 115, 170
3	11 – 13.8	172, 152, 166, 182, 334, 266, 176, 153, 165, 330, 284, 264, 174, 154, 77, 332, 286, 268
4	13.8 – 18	266, 179, 202, 122, 268, 212, 203, 284, 178, 213, 244, 286
5	18 – 22	244, 229, 167, 122, 226, 202, 228, 149, 203
6	22 – 34.7	264, 149, 253, 278, 263, 150, 250, 139, 265, 252, 276, 138

Table 3 - DFTPP KEY IONS AND ION ABUNDANCE CRITERIA	
Mass	**Ion Abundance Criteria**
51	30-60 of mass 198
68	<2 % of mass 69
70	<2 % of mass 69
127	40-60 % of mass 198
197	<1 % of mass 198
198	Base peak, 100 % relative abundance
199	5-9 % of mass 198
275	10-30 % of mass 198
365	>1 % of mass 198
441	Present but less than mass 443
442	>40 % of mass 198
443	17-23 % of mass 442

Table 4 – INTERNAL STANDARDS	
Internal Standard (Full Scan)	**Prim/Sec. ions**
1,4-Dichlorobenzene-d4	152 / 150, 115
Naphthalene-d8	136 / 68
Acenaphthene-d10	164 / 162, 160
Phenanthrene-d10	188 / 94, 80
Chrysene-d12	240 / 120, 236
Perylene-d12	264 / 260, 265
Internal Standard (SIM)	**Prim/Sec. ions**
1,2-Dichlorobenzene-d4	152/ 150
1-Methylnaphthalene-d10	150/ 152, 122
Fluorene-d10	174/ 176
Fluoranthene-d10	212/ 213
Benzo(a)pyrene- d12	264/ 263, 265

Table 6 – Full Scan Semivolatile Internal Standards with Corresponding Analytes Assigned for Quantitation			
1,4-Dichlorobenzene-d4	**Ions**	**Acenaphthene-d10**	**Ions**
Aniline	(93/66,65)	Acenaphthene	(154/153,152)
Benzaldehyde	(105)	Acenaphthylene	(152/151,153)
Benzenethiol	(110)	1-Chloronaphthalene	(162/127,164)
Benzyl alcohol	(108/79,77)	2-Chloronaphthalene	(162/127,164)
Bis(2-chloroethyl)ether	(93/63,95)	4-Chlorophenylphenyl ether	(204/206,141)
Bis (2-chloroisopropyl)ether	121	Dibenzofuran	(168/139)
2-Chlorophenol	(128/64,130)	Diethyl phthalate	(149/177,150)
Cumene	(105,120)	Dimethyl phthalate	(163/149,164)
Decane	(43)	m-Dinitrobenzene	(168)
1,3-Dichlorobenzene	(146/148,111)	2,4-Dinitrophenol	(184/63,154)
1,4-Dichlorobenzene	(146/148,111)	2,4-Dinitrotoluene	(165/63,89)
1,2-Dichlorobenzene	(146/148,111)	2,6-Dinitrotoluene	(165/63,89)
1,4 Dioxane	(88)	Fluorene	(166/165,167)
Ethyl methanesulfonate	(79/109,97)	Hexachlorocyclopentadiene	(295/237,142)
2-Fluorophenol (SURR.)	(112)	1,4 – Naphthoquinone	(158)
Hexachloroethane	(117/201,199)	1- Naphthylamine	(143/115,116)
Indene	(116)	2- Naphthylamine	(143/115,116)
Methyl methanesulfonate	(80/79,64)	2-Nitroaniline	(65/92,138)
2-Methylphenol	(108/107,79)	3-Nitroaniline	(138/108,92)
4-Methylphenol	(108/107,79)	4-Nitroaniline	(138/108,92)
N-Nitrosodiethylamine	(102)	4-Nitrophenol	(139/109,65)
N-Nitrosodimethylamine	(74/42)	5 Nitro-o-toluidine	(152)
N-Nitroso-di-n-propylamine	(70/101,130)	Pentachlorobenzene	(250/252,248)
N-Nitrosomethyethylamine	(42)	Pentachloronitrobenzene	(237/235,272)
N-Nitrosomorpholine	(56)	Phenacetin	(108/109,179)
N-Nitrosoptrrolidine	(41)	Phorate	(75)
O-Toluidine	(106)	Pronamide	(173/175,145)
Petachloroethane	(167)	1,2,4,5-Tetrachlorobenzene	(216/214,218)
Phenol	(94)	2,3,4,6-Tetrachlorphenol	(232/230,131)
Phenol-d5 (SURR.)	(99)	Tetraethyldithiopyrophosphate	(322)
2-Picoline	(93/66,92)	Thioazin	(143)
Pyridine	(79)	2,4,6-Trichlorophenol	(196/198,200)
		2,4,5-Trichlorophenol	(196/198,200)

Table 6 (cont'd) – Full Scan Semivolatile Internal Standards with Corresponding Analytes Assigned for Quantitation			
Naphthalene-d8	**Ions**	**Phenanthrene-d10**	**Ions**
A,A-Dimethylphenethylamine	(58)	4-Aminobiphenyl	(169/168,170)
Acetophenone	(105/77,51)	Anthracene	(178/176,179)
Benzoic acid	(184/92,185)	Atrazine	(58)
Bis(2-chloroethoxy)methane	(93/95,123)	4-Bromophenyl phenyl ether	(248/250,141)
Caprolactam	(55)	Carbazole	(167)
4-Chloroaniline	(127)	Diallate	(86)
4-Chloro-methylphenol	(107/144)	Dimethoate	(87)
2,3 Dichloroaniline	(161)	Di-n-Butyl phthalate	(149/150)
2,4-Dichlorophenol	(162/164,98)	4,6-Dinitro-2-methylphenol	(198/51,105)
2,6-Dichlorophenol	(162/164,98)	Dinoseb	(211)
Dimethylnaphthalene	(156)	Diphenylamine	(169/168,167)
2,4-Dimethylphenol	(122/107)	1,2-Diphenylhydrazine	(77/105)
a,a-Dimethyl-phenethylamine	(58/91,42)	Disulfoton	(88)
Hexachlorobutadiene	(225/223,227)	Fluoranthene	(202/101,203)
Hexachloroprene	(213)	2-Fluorobiphenyl (SURR)	(172)
Isophorone	(82/95,138)	Hexachlorobenzene	(284/142,249)
Isosafrole	(127)	Isodrin	(193)
1-Methylnaphthalene	(142)	Methapyriline	(58)
2-Methylnaphthalene	(142/141)	Methyl Parathion	(125)
Naphthalene	(128/129,127)	N-Nitrosodiphenylamine	(169/168,167)
Nitrobenzene	(77/123,65)	4-Nitroquinoline 1-oxide	(190)
Nitrobenzene-d5 (SURR.)	(82)	Octadecane	(57)
N-Nitroso-di-n-butylamine	(84/57/41)	Parathion	(109)
2-Nitrophenol	(139/109,65)	Pentachlorophenol	(266/264,268)
Quinoline	(129)	Phenanthrene	(178/179,176)
N-Nitrosopiperidine	(42/114,55)	Pronamide	(173)
p-Phenylenediamine	(108)	sym- Trinitrobenzene	(213)
O,O,O-Triethylphosphorthioat	(198)	2,4,6 Tribromophenol (SURR)	(330)
Safrole	(162)		
alpha –Terpineol	(128)	**Perylene-d12**	**Ions**
1,2,3-Trichlorobenzene	(180/182,145)	Benzo(b)fluoranthene	(252/125)
1,2,4-Trichlorobenzene	(180/182,145)	Benzo(k)fluoranthene	(252/125)
1,3,5-Trichlorobenzene	(180/182,145)	Benzo(g.h.i)perylene	(276/138,277)
		Benzo(a)pyrene	(252/253,125)
Chrysene-d12	**Ions**	Dibenz(a,j)acridine	(279/280)
2 –Acetylaminofluorene	(181)	Dibenz(a,h)anthracene	(278/139,279)
Aramite	(194)	7,12-Dimethylbenz(a)anthracene	(256/241,257)
Benzidine	(184)	Di-n-Octyl Phthalate	(149)
Benzo(a)anthracene	(228/229/226)	Hexachlorophene	(196)
Bis(2-ethylhexyl)phthalate	(149/167,279)	Indeno(1,2,3-d)pyrene	(276)
Butylbenzyl phthalate	(149/91)	3-Methylchloanthrene	(268/253)
Chlorobenzilate	(251)		
Chrysene	(228/226,229)		
3,3'-Dichlorobenzidine	(252/254,126)		
p-Dimethylaminoazobenzene	(120/225,77)		
3,3 Dimethylbenzidine	(212)		
Famphur	(218)		
Kepone	(272)		
Methyl Chrysene	(242)		

Pyrene	(202/200,203)		
Terphenyl-d14 (SURR.)	(244)		
Table 6a – SIM Semivolatile Internal Standards with Corresponding Analytes Assigned for Quantitation			
1,4-Dichlorobenzene-d4	**Ions**	**Fluoranthene-d10**	**Ions**
2-Fluorophenol (Surr)	(112)	Fluoranthene	202, 101, 203
Phenol-d5 (Surr)	(99)	Pyrene	202, 203
Bis-(2-chloro-ethyl)ether	93, 63, 95	Terphenyl-d14 (Surr)	(244)
Nitrobenzene-d5 (Surr)	(82)	Benzo(a)anthracene	228, 229, 226
		Chrysene	228, 226, 229
1-Methylnaphthalene-d10	**Ions**	Bis(2-ethylhexylphthalate	149, 167, 279
Naphthalene	128, 129, 127		
Hexachlorobutadiene	225, 223, 227	**Benzo(a) pyrene-d12**	**Ions**
2-Methyl Naphthalene	142, 141, 115	Di-n-octyl phthalate	149, 150, 43
2-Fluorobiphenyl (Surr)	(172)	Benzo(b)fluoranthene	252, 253
		Benzo(k)fluoranthene	252, 125
Fluorene-d10	**Ions**	Benzo(a)pyrene	252, 253, 125
Acenaphthylene	152, 151, 153	Indeno(1,2,3-cd)pyrene	276, 277, 138
Acenaphthene	153, 152, 154	Dibenzo(a,h)anthracene	278, 139, 279
Fluorene	166, 165, 167	Benzo(g,h,i)perylene	276, 138, 277
1,2-Diphenylhydrazine	77, 105, 182		
2,4,6-Tribromophenol (Surr)	(330)		
Hexachlorobenzene	284, 286		
Pentachlorophenol	266, 264		
Phenanthrene	178, 179, 176		
Anthracene	178, 176, 179		

Table 7. STANDARD PREPARATION

Table 7A – Intermediate Calibration Standard Solution				
Stock Solution	**Stock Conc., µg/ml**	**Volume Added, µl**	**Final Vol. in $MeCl_2$, ml**	**Final Conc., µg/ml**
Semivolatile Standard Mix # 1	2,000	500	10	100
Semivolatile Standard Mix # 2	2,000	500	10	100
Semivolatile Standard Mix # 4	2,000	500	10	100
Semivolatile Standard Mix # 5	2,000	500	10	100
Semivolatile Standard Mix # 6	2,000	500	10	100
Semivolatile Standard Mix # 7	2,000	500	10	100
PAH Mixture #2	2,000	500	10	100
Semivolatile Standard Mix # 8	2,000	500	10	100
Additional Requested Compound(s) Mix	2,000	500	10	100
Pyridines Mixture	2,000	500	10	100
1,2,3-Trichlorobenzene	1,000	1,000	10	100
1,3,5-Trichlorobenzene	1,000	1,000	10	100
Butyl Stearate	10,000	200	10	200
Pentachlorophenol	1,000	1,000	10	100
B/N Surrogate Standard Mix	5,000	200	10	100
Acid Surrogate Standard Mix	7,500	134	10	100.5

Table 7B – Intermediate Calibration Standard Solution -SIM				
Stock Solution	Stock Conc., µg/ml	Volume Added, µl	Final Vol. in $MeCl_2$, ml	Final Conc. µg/ml
Semivolatile Standard Mix # 1	2,000	50	10	10
Semivolatile Standard Mix # 2	2,000	50	10	10
Toxic #2	2,000	50	10	10
PAH Mixture #2	2,000	50	10	10
Semivolatile Standard Mix # 8 (Acids)	2,000	250	10	50
1-Methynaphthalene	1,000	100	10	10
B/N Surrogate Standard Mix	5,000	100	10	50
Acid Surrogate Standard Mix (Full Scan)	7500	67	10	50

Table 7C – Initial Calibration Standards Prep Scheme

Standard Solution	Intermediate Conc., µg/ml	Intermediate added, µl Full Scan	Final Volume in $MeCl_2$, ml	Final Conc., µg/ml – Full Scan
STD 1	100	1,000	1	100
STD 2	100	800	1	80
STD 3	100	500	1	50
STD 4	100	250	1	25
STD 5	100/10 (SIM)	100	1	10
STD 6	100	50	1	5
STD 7	100	20	1	2
STD8	100	10	1	1

Table 7D Initial Preparation Standards Prep Scheme - SIM				
Standard Solution	Intermediate Conc., µg/ml	Intermediate added, µl SIM	Final Volume in $MeCl_2$, ml	Final Conc., µg/ml – SIM Scan
STD 1	10/50	500	1	5 BN / 25 Acids
STD 2	10/50	250	1	2.5 BN / 12.5 Ac
STD 3	10/50	100	1	1 BN / 5 Acids
STD 4	1	200	1	0.2 BN / 1 Acids
STD 5	1	100	1	0.1 BN / 0.5 Acids
STD7	0.1	500	1	0.05 BN / 0.25 AC
STD 6	0.1	200	1	0.02 BN / 0.1 AC

Table 7E– ICV -Second Source Calibration Check Standard				
Intermediate	Intermediate Conc., µg/ml	Volume Used, µl (Full/SIM)	Final Volume in Acetone, ml	Final Conc., µg/ml (Full/SIM)
Base Neutrals Mixture	100	500/ 50	1	50/ 5
Acid Mixture	100	500/ 50	1	50/ 5

Table 8a –Selected Ion Monitoring: Masses and Dwell Times		
Compound	Mass Ion (m/z)	Dwell Time (ms)
Acenaphthene	153, 152, 154	50
Acenaphthylene	152, 151, 153	50
Anthracene	178, 176, 179	50
Benzo(a)anthracene	228, 229, 226	50
Benzo(a)pyrene	252, 253, 125	50
Benzo(b)fluoranthene	252, 253	50
Benzo(g,h,i)perylene	276, 138, 277	50
Benzo(k)fluoranthene	252, 125	50
Chrysene	228, 226, 229	50
Dibenzo(a,h)anthracene	278, 139, 279	50
Fluoranthene	202, 101, 203	50
Fluorene	166, 165, 167	50
Indeno(1,2,3-cd)pyrene	276, 277, 138	50
Naphthalene	128, 129, 127	50
Phenanthrene	178, 179, 176	50
Pyrene	202, 203	50
2-Methyl Naphthalene	142, 141, 115	50
Bis-(2-chloro-ethyl)ether	93, 63, 95	50
Pentachlorophenol	266, 264	50
Hexachlorobutadiene	225, 223, 227	50
1,2-Diphenylhydrazine	77, 105, 182	50
Bis(2-ethylhexylphthalate	149, 167, 279	50
Di-n-octyl phthalate	149, 150, 43	50
Hexachlorobenzene	284, 286	50
2-Fluorophenol	112, 64, 63	50
Phenol-d5	99, 42	50
Nitrobenzene-d5	82, 128	50
2-Fluorobiphenyl	172, 171, 170	50
2,4,6-Tribromophenol	330, 332, 334	50
Terphenyl-d14	244, 122	50

Table 9. REPORTING LIMITS

Compound	Water	Soil	Compound	Water	Soil
	µg/l	µg/kg		µg/l	µg/kg
Benzoic Acid	20	667	Chlorobenzilate	5	167
2-Chlorophenol	5	167	Chrysene	1	33
4-Chloro-3-methylphenol	5	167	bis(2-Chloroethoxy)methane	2	67
2,4-Dichlorophenol	5	167	bis(2-Chloroethyl)ether	2	67
2,4-Dimethlyphenol	5	167	Bis(2-Chloroisopropyl)ether	2	67
2,4-Dinitrophenol	20	667	4-Chlorophenyl phenyl ether	2	67
4,6-Dinitro-o-cresol	20	667	1,2-Dichlorobenzene	2	67
Dinoseb	5	167	1,3-Dichlorobenzene	2	67
2-Methylphenol	2	67	1,4-Dichlorobenzene	2	67
4-Methylphenol	2	67	2,4-Dinitrotoluene	2	67
2-Nitrophenol	5	167	2,6-Dinitrotoluene	2	67
4-Nitrophenol	10	333	3,3'-Dichlorobenzidine	5	167
Pentachlorophenol	10	333	3,3'-Dimethylbenzidine	5	167
Phenol	2	67	7,12-Dimethylbenz(a)anthracene	5	167
2,3,4,6-Tetrachlorophenol	5	167	Diallate	5	167
2,4,5-Trichlorophenol	5	167	Dibenzo(a,h)anthracene	1	33
2,4,6-Trichlorophenol	5	167	Dibenzofuran	2	67
2-Acetylaminofluorene	5	167	Dimethoate	5	167
4-Aminobiphenyl	5	167	Diphenylamine	5	167
Acenaphthene	1	33	Disulfuton	5	167
Acenaphthylene	1	33	m-Dinitrobenzene	5	167
Acetophenone	5	167	p-(Dimethylamine)azobenzene	5	167
Aniline	2	67	Di-n-butyl phthalate	2	67
Anthracene	1	33	Di-n-octyl phthalate	2	67
Aramite	5	167	Diethyl phthalate	2	67
A,A-Dimethylphenethylamine	5	167	Dimethyl phthalate	2	67
Benzo(a)anthracene	1	33	bis(2-Ethylhexyl)phthalate	2	67
Benzo(a)pyrene	1	33	Ethyl methansulfonate	5	167
Benzo(b)fluoranthene	1	33	Famphur	30	1000
Benzo(g,h,i)perylene	1	33	Fluoranthene	1	33
Benzo (k)fluoranthene	1	33	Fluorene	1	33
4-Bromophenyl phenyl ether	2	67	Hexachlorobenzene	2	67
Butyl benzyl phthalate	2	67	Hexachlorobutadiene	1	33
Benzyl Alcohol	2	67	Hexachlorocyclopentadiene	20	667
2-Chloronaphthalene	2	67	Hexachloroethane	5	167
4-Chloroaniline	5	167	Hexachlorophene	50	1700
Carbazole	1	67	Hexachloropropene	5	167

Table 9 (Cont'd)

Compound	Water	Soil	Compound	Water	Soil
	µg/l	µg/kg		µg/l	µg/kg
Indeno(1,2,3-cd)pyrene	1	33	N-Nitrosomethylethylamine	5	167
Isodrin	5	167	N-Nitrosomorpholine	5	167
Isophorone	2	67	N-Nitrosopiperidine	5	167
Isosafrole	5	167	N-Nitrosopyrrolidine	5	167
Kepone	30	1000	O,O,O Triethylphosphorothioat	5	167
2-Methylnaphthalene	2	667	2-Picoline	5	167
3-Methylcholanthene	5	167	Parathion	5	167
Methapyrilene	5	167	Pentachlorobenzene	5	167
Methyl Methanesulfonate	5	167	Pentachloroethane	5	167
Methyl Parathion	5	167	Pentachloronitrobenzene	5	167
1,4 Naphthoquinone	5	167	Phenacetin	5	167
1-Naphthylamine	5	167	Phenanthrene	1	33
2-Naphthylamine	5	167	Phorate	5	167
2-Nitroaniline	5	167	Pronamide	5	167
3-Nitroaniline	5	167	Pyrene	1	33
4-Nitroaniline	5	167	Pyridine	2	67
5-Nitro-o-toluidine	5	167	p-Phenylenediamine	5	167
Naphthalene	1	33	Safrole	5	167
Nitrobenzene	2	67	1,2,4,5 Tetrachlorobenzene	5	167
n-Nitrosodimethylamine	2	67	1,2,4-Trichlorobenzene	2	67
4-Nitroquinoline-1-Oxide	10	333	Thionazin	5	167
N-Nitroso-di-n-propylamine	2	67	o-Toluidine	5	167
N-Nitrosodi-n-butylamine	5	167	sym-Trinitrobenzene	5	167
N-Nitrosodiethylamine	5	167	Tetraethyl dithiopyrophosphate	5	167
N-Nitrosodiphenylamine	5	167			

Table 10. Selected Ion Monitoring Reporting Limits

Compound	Water	Soil	Compound	Water	Soil
	µg/l	µg/kg		µg/l	µg/kg
Pentachlorophenol	0.3	17	Fluoranthene	0.1	3.3
Acenaphthene	0.1	3.3	Fluorene	0.1	3.3
Acenaphthylene	0.1	3.3	Hexachlorobenzene	0.02	3.3
Anthracene	0.1	3.3	Hexachlorobutadiene	0.1	3.3
Benzo(a)anthracene	0.1	3.3	Indeno(1,2,3-cd)pyrene	0.1	3.3
Benzo(a)pyrene	0.1	3.3	2-Methylnaphthalene	0.1	3.3
Benzo(b)fluoranthene	0.1	3.3	Naphthalene	0.1	3.3
Benzo(g,h,i)perylene	0.1	3.3	Phenanthrene	0.1	3.3
Benzo (k)fluoranthene	0.1	3.3	Pyrene	0.1	3.3
Chrysene	0.1	3.3	bis(2-Chloroethyl)ether	0.2	6.6
Dibenzo(a,h)anthracene	0.1	3.3	Bis (2-ethylhexyl) phthalate	0.2	6.6
1,2-Diphenylhydrazine	0.2	6.6	Di-n-octyl phthalate	0.2	6.6

Lab. Manager:

QA Manager:

Effective Date: 12/15/2010

Title: **EXTRACTION OF SEMIVOLATILE ORGANICS FROM SOLIDS BY SONICATION (Base, Neutral, Acid Organics; Pesticides, Polychlorinated Biphenyls, Diesel Range Organics)**

METHOD REFERENCE: SW-846, Method 3550C (Rev 3. February 2007)

Applicable Matrices: Soils, Sediments, Wipes and Sludges

Revised Sections: ***1.1.1,***
Added Sections 10.8.6, 10.8.7,10.8.8, 10.8.9, 12.4

1.0 Scope and Application.

1.1 This method describes the extraction procedure of semi-volatile organic compounds (Base, Neutral, Acid Organics; Pesticides, Polychlorinated Biphenyls) in soil, sludge, wipes and other solid matrices for analysis by gas chromatograph/mass spectrometer (GC/MS), gas chromatography/ electron capture detector (GC/ECD), gas chromatography/ flame ionization detector (GC/FID), or high performance liquid chromatography (HPLC).

1.1.1 This method is used primarily for Method 8270 , Base Neutral and Acid extractables, 8100, and 8310, PAH's. Pesticides, PCB's and other soil extracts are generally prepared using Accelerated Solvent Extraction, EOP040A. The procedures for all methods are included in this SOP Herbicide extraction for soils is described in EGC8151.

2.0 Summary

2.1 A 30-gram aliquot of sample is mixed with anhydrous sodium sulfate. Wipe samples are extracted in their entirety, without weighing. The mixture is extracted with methylene chloride/acetone 3 times using ultrasonic extraction. The extract is decanted and concentrated for analysis using instrumental techniques using SW-846 Methods 8081B, 8082A, 8100, 8270D, 8015B and 8310. Where necessary, solvent exchange from methylene chloride to hexane is performed prior to analysis to accommodate instrument detectors. Alternatively, a 2-gram sample is extracted once with 10ml of with methylene chloride/acetone. The extract is filtered and adjusted to the desired volume for analysis using instrumental techniques using SW-846 Methods 8081B, 8082A, 8100, 8270D 8015B and 8310.

3.0 Reporting Limit and Method Detection Limit

3.1 See determinative method.

4.0 Definitions

BLANK - an analytical sample designed to assess specific sources of laboratory contamination. See individual types of Blanks: Method Blank, Instrument Blank, Storage Blank, and Sulfur Blank.

CLASS A GLASSWARE – Volumetric laboratory glass that has been manufactured, calibrated and certified to established ASTM volume standards. Class A glassware does not require volume calibration or verification.

KUDERNA DANISH – A three-stage glass solvent concentration device consisting of a large volume receiving flask (250 or 500ml), a small volume concentrator tube and a three-ball air cooled condenser. Use this device to evaporate large volumes of solvent used for organic extractions to increase the concentration of the analyte in the solvent.

MATRIX - the predominant material of which the sample to be analyzed is composed. For the purpose of this SOW, a sample matrix is either water or soil/sediment. Matrix is not synonymous with phase (liquid or solid).

MATRIX SPIKE - aliquot of a matrix (water or soil) fortified (spiked) with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery.

MATRIX SPIKE DUPLICATE - a second aliquot of the same matrix as the matrix spike (above) that is spiked in order to determine the precision of the method.

METHOD BLANK - an analytical control consisting of all reagents, internal standards, and surrogate standards that is carried throughout the entire analytical procedure. The method blank is used to define the level of laboratory, background, and reagent contamination.

PERCENT DIFFERENCE (%D) - As used in this SOW and elsewhere to compare two values, the percent difference indicates both the direction and the magnitude of the comparison, i.e., the percent difference may be either negative, positive, or zero. (In contrast, see relative percent difference.)

PERCENT MOISTURE - an approximation of the amount of water in a soil/sediment sample made by drying an aliquot of the sample at 105°C. The percent moisture determined in this manner also includes contributions from all compounds that may volatilize at or below 105 °C, including water. Percent moisture may be determined from decanted samples and from samples that are not decanted.

REAGENT WATER - water in which an interferant is not observed at or above the minimum quantitation limit of the parameters of interest.

SEPARATORY FUNNEL – A large volume (500, 1000 or 2000ml) closed funnel used for separating immiscible liquids from each other. The device is used for shaking samples with solvent to extract organic constituents. One of the phases of the mixture is removed through the stopcock opening in the base to effect the separation.

TURBOVAP CONCENTRATOR – An automated device for the concentration of organic solvent extracts concentration. The apparatus is capable of accepting whole volume extracts and automatically evaporating and concentrating solvent extracts to a pre-designated volume using a water bath heated to a specified temperature combined with a nitrogen blow-down system.

ULTRASONIC – High frequency sound waves that increase molecular vibration of molecules absorbed to surfaces of solid materials. The process can readily mobilize adsorbed organics from solids into organic solvents.

WIPE – An inert fabric of known area used to swab the surface of a contaminated area for the purpose of removing the contamination from the surface for chemical analysis.

5.0 Health and Safety

5.1 The analyst must follow normal safety procedures as outlined in the Accutest Laboratory Safety Manual which includes the use of safety glasses and lab coats. In addition, all acids are corrosive and must be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical must be treated as a potential health hazard. Exposure to these reagents must be reduced to the lowest possible level. The laboratory maintains a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets is available to all personnel involved in these analyses.

5.3 Primary standards of toxic compounds must be prepared in a hood. A NIOSH/Mass approved toxic gas respirator should be worn when the analyst handles high concentrations of toxic compounds.

6.0 Interferences

6.1 Solvents, reagents, glassware, and other sample processing hardware may yield artifacts and/or interferences to sample analysis. Blanks must be analyzed to demonstrate that these materials are free from interferences under the conditions of the analysis.

6.2 Interferences co-extracted from the samples will vary considerably from source to source. If interferences prevent the analysis of an extracted sample, further cleanup of the sample extract may be employed if necessary. Refer to SW-846 Method 3600 for cleanup procedures.

6.3 Phthalate esters contaminate many types of products commonly found in the laboratory. Avoid plastics in particular because they contain phthalates, used as plasticizers, which can leach from these materials. Practice sound, consistent materials control to avoid phthalate contamination, which may occur at any time. Soap residue (e.g. sodium dodecyl sulfate), which results in a basic pH on glassware surfaces, may cause degradation of certain analytes. Specifically, Aldrin, Heptachlor, and most organophosphorus pesticides will degrade in this situation. This occurs in glassware that is difficult to rinse (e.g., 500-mL K-D flask). Carefully hand-rinse these items to avoid this problem.

7.0 Collection, Preservation and Holding Times

7.1 Collect samples in 250-mL widemouth glass amber bottles.

7.2 Collect wipe samples in 150-mL widemouth glass amber bottles.

7.3 Cool samples to $\leq 6^{\circ}C$ and store at $\leq 6^{\circ}C$ until extraction.

7.4 Thirty (30) grams of solid samples are required for an extraction. Additional sample volume may be necessary for any samples used for matrix duplicates and matrix spikes.

7.5 Extract samples within 14 days of sampling and analyze the extract within 40 days of the extraction.

7.6 Store the base, neutral, & acid sample extracts at –10°C in amber vials (protected from light) sealed with PTFE-lined septa. Store pesticide & PCB extracts at 4°C in the same type vial.

8.0 Apparatus and Materials

8.1 Beakers - 250 ml or 250 ml Erlenmyer flasks.

8.2 Sonicator/sonic disrupter, 300 watt output minimum, with soundproof casing.

8.2.1 The sonicator must be tuned to manufacturer's specifications prior to each use. Document tuning activities in the tuning logbook.

8.2.2 A ¾-horn for the low concentration method procedure and a 1/8-inch tapered microtip attached to a ½-inch horn for the medium/high concentration procedure.

8.3 Drying column – glass funnel containing pre-washed filter paper and sodium sulfate.

8.4 Kudema-Danish (K-D) Evaporator

8.4.1 500 & 250 ml receiving flasks
8.4.2 three ball Snyder column
8.4.3 10ml graduated concentrator tubes
8.4.4 Class A volumetric vessels: 1ml, 5ml and 10ml

8.5 TurboVap concentrator Apparatus(Zymark or equivalent)

8.6 TurboVap concentrator tubes – 200ml

8.7 1ml volumetric pipettes or pre-calibrated 1ml syringe

8.8 2ml crimp vials

8.9 Glass Wool

8.10 Porous Boiling Chips or Glass beads, solvent extracted

8.11 Evaporating steam baths capable of temperatures from 55 - 90°C .

8.11.1 Record the operating temperature daily with use.

8.12 Nitrogen blow down apparatus with waterbath, capable of maintaining a temperature of 35°C+/-3°C.

8.12.1 Record the operating temperature daily with use.

8.13 Top Loading balance, capable of weighing to 0.01g.

8.14 Cotton fabric cloth wipe 5cm^2, pre washed with hexane.

8.15 Class A volumetric flasks: 1ml, 5ml, 10ml.

8.16 Disposable wood spatulas

9.0 Reagents

9.1 Hexane – reagent grade for pesticide residue analysis.

9.2 Acetone – reagent grade for trace organic analysis.

9.3 Methylene Chloride– reagent grade for trace organic analysis.

9.4 Methylene Chloride/Acetone, 1:1 - reagent grade for trace organic analysis – mix equal parts of each solvent.

9.5 Sodium sulfate - granular anhydrous, prepared by baking at 400°C for a minimum of 4 hours.

9.6 Nitrogen Gas – High Purity Grade.

9.7 Whatman 41 filter paper (or equivalent)

9.8 Surrogate and Matrix Spiking Solutions. See SOP for target compound specifications.

Method	Surrogate Conc.	Vol Spike ml	Target CMPD Spike Conc.	Vol Spike ml	SOP
SW 846-8081B	400 ng/ml	1.0	250 ng/ml	1.0	EGC8081B
SW 846-8081B Tox	400 ng/ml	1.0	5 µg/ml	1.0	EGC8081B
SW 846-8081B Chl	400 ng/ml	1.0	4 µg/ml	1.0	EGC8081B
SW 846-8082A	400 ng/ml	1.0	2 ug/ml	1.0	EGC8082A
SW 846-8100	100 ug/ml	1.0	10 ug/ml	1.0	EGC8100
SW 846-8270D BN	100 ug/ml	0.5	100 ug/ml	0.5	EMS8270D
SW 846-8270D Ac	100 ug/ml	0.5	100 ug/ml	0.5	EMS8270D
SW 846-8015B	50 µg/ml	1.0	1000 µg/ml	1.0	EGC8015B
SW 846-8310	10 µg/ml	1.0	10 µg/ml	1.0	EGC8310

9.8.1 Pesticide Surrogate: SW 846-8081B.

9.8.1.1 Prepare surrogate from a 200 ug/ml solution of decachlorobiphenyl / Tetrachloro-m-Xylene obtained from commercial sources.

9.8.1.2 Dilute the commercial stock 1:500 in acetone. The final solution concentration is 400 ng/ml.

9.8.2 Pesticide Target Compound: SW 846-8081B.

9.8.2.1 Prepare target compound spike from a 10 ug/ml stock solution of the target organochlorine pesticides obtained from commercial sources.

9.8.2.2 Dilute the commercial stock 1:40 in acetone. The final solution concentration is 250 ng/ml.

9.8.2.3 Prepare a Toxaphene spike if required from a 100 µg/ml stock solution obtained from commercial sources. Dilute the commercial stock 1:20 in acetone. The final solution concentration is 5 µg/ml.

9.8.2.4 Prepare a Chlordane spike if required from a 100 µg/ml stock solution obtained from commercial sources. Dilute the commercial stock 1:25 in acetone. The final solution concentration is 4 µg/ml.

9.8.3 PCB Surrogate: SW 846-8082A. See 9.8.1

9.8.4 PCB Target Compound: SW 846-8082A.

9.8.4.1 Prepare target compound spike from a 1000 ug/ml solution of Aroclor 1016 and Aroclor 1260 obtained from commercial sources.

9.8.4.2 Dilute the commercial stock 1:500 in acetone. The final solution concentration is 2.0 ug/ml.

9.8.5 PAH Surrogate: SW-846-8100. See 9.8.7.

9.8.6 PAH Target Compound: SW-846-8100

9.8.6.1 Prepare target compound spike from a 2000 ug/ml solution of PAH target compounds obtained from commercial sources.

9.8.6.2 Dilute the commercial stock 1:200 in acetone. The final solution concentration is 10.0 ug/ml.

9.8.7 BN Surrogate: SW-846-8270D

9.8.7.1 Prepare surrogate from a 5000 ug/ml stock solution of base neutral surrogate compounds obtained from commercial sources.

9.8.7.2 Dilute the commercial stock 1:50 in acetone. The final solution concentration is 100 ug/ml.

9.8.8 BN Target Compound: SW-846-8270D

9.8.8.1 Prepare single target compound spike solutions from five (5) base neutral stock solutions obtained from commercial sources. Dilute the stocks in acetone combining the final solution into a 50 ml volumetric flask as follows:

Solution Name	Stock Conc. ug/ml	Volume Used ml/50ml	Dilution Factor	Final Conc. Ug/ml
Semi-Volatile Mix	1000	5.0	10	100
Base Neutral Mix	1000	5.0	10	100
Benzidines	2000	2.5	20	100
Methylnaphthalenes	2000	2.5	20	100
Cumene	5000	1.0	50	

9.8.9 Ac Surrogate: SW-846-8270D

9.8.9.1 Prepare surrogate from a 10,000 ug/ml solution of acid surrogates obtained from commercial sources.

9.8.9.2 Dilute the commercial stock 1:100 in acetone. The final solution concentration is 100 ug/ml.

9.8.10 Ac Target Compound: SW-846-8270D

9.8.10.1 Prepare target compound spikes from a 1000 ug/ml solution of acid target compounds obtained from commercial sources.

9.8.10.2 Dilute the commercial stock 1:10 in acetone. The final solution concentration is 100 ug/ml.

9.8.11 DRO Surrogate SW-846-8015B

9.8.11.1 Prepare Surrogate from a 1000 µg/ml solution of stock surrogate obtained from commercial sources.

9.8.11.2 Dilute the commercial stock 1:20 in acetone. The final solution concentration is 50 µg/ml

9.8.12 DRO Target Compound SW-846-8015B

9.8.12.1 Prepare target compound spike from a 50000 µg/ml solution of DRO spiking solution obtained from commercial sources.

9.8.12.2 Dilute the commercial stock 1:50 in acetone. The final solution Concentration is 1000 µg/ml

9.8.13 PAH Surrogate SW-846-8310

9.8.13.1 Prepare PAH surrogate from a 1000 ug/ml solution of stock surrogates obtained from commercial sources. Each surrogate is in a separate solution (p-Terphenyl & o-Terphenyl).

9.8.13.2 Dilute each commercial stock 1:100 in acetone. The final solution concentration is 10 µg/ml

9.8.14 PAH Target Compound SW-846-8310

9.8.14.1 Prepare target compound spike from a 500 µg/ml stock PAH mix and 1000 µg/ml stock solutions of 1 & 2 methylnaphthalene obtained from commercial sources.

9.8.14.2 Dilute the PAH mix 1:50 in acetone, and the 1 & 2 methylnaphthalene 1:100 in acetone. The final solution concentration is 10 µg/ml.

9.9 Unopened stock solutions must be stored according to the manufacturers documented holding time and storage temperature recommendations.

9.10 After opened, stock standards must be replaced after 6 months or sooner if manufacturer's expiration date comes first or comparison with quality control check samples indicated degradation.

9.11 Copper Powder Mesh: Aldrich powder, 150 mesh or equivalent

9.11.1 Add copper to a 50ml volumetric flask.
9.11.2 Add 5% Nitric Acid , slurry for 15-20 seconds
9.11.3 Rinse 3-4 times with deionized water.
9.11.4 Rinse with Acetone
9.11.5 Dry with Nitrogen
9.11.6 The copper should be pink and shiny.
9.11.7 Store in an amber vial covered with hexane.

10.0 Procedure

10.1 Obtain custody for the samples selected for analysis and group them into a sample batch. A batch consists of 20 samples, a method blank and a spiked blank extracted on the same day. A matrix spike (sample) and a matrix spike duplicate (sample) are prepared for every 20 sample extracted. Generate the method blank and spiked blank in the laboratory using 30 grams of sodium sulfate for each sample.

10.2 Sediment/soil samples - Decant and discard any water layer on the sediment. Mix samples thoroughly, especially composited samples. Discard any foreign objects such as sticks, leaves, and rocks. See SOP EQA042 for additional sample homogenization detail.

10.3 Dry waste samples amenable to grinding - Grind or otherwise subdivide the waste so that it either passes through a 1-mm sieve or can be extruded through a 1-mm hole. Introduce sufficient sample into the grinding apparatus to yield at least 10 g after grinding.

10.4 Gummy, fibrous or oily materials not amenable to grinding should be cut, shredded, or otherwise reduced in size to allow mixing and maximum exposure of the sample surfaces for the extraction. The addition of anhydrous sodium sulfate to the sample (1:1) may make the mixture amenable to grinding.

10.5 Wipes – Transfer the entire wipe and any remaining solvent into the extraction vessel. Weighing is unnecessary.

10.6 Percent Dry Weight Determination - Dry weight determination is performed by another department and incorporated into the final result calculation after sample extraction has been performed.

10.7 **Low level concentration of organics (<= 20 mg/kg) expected:**

10.7.1 Weigh out approximately 30 g of wet weight soil into a tarred 250 ml beaker and record the weight to the nearest 0.1 g. Samples that do not have a free flowing texture (sandy) are mixed with approximately 60-g anhydrous sodium sulfate to form a free flowing mixture. A sample should be weighed in triplicate for the batch matrix spike and matrix spike duplicate.

10.7.2 Weigh out 30 grams of anhydrous sodium sulfate into each of two, clean 150ml beakers to be used as the method blank and spiked blank. An empty beaker is used as a method blank and spiked blank and should be treated as a sample starting with 10.9.

10.7.3 Wipe samples are transferred to the extraction beaker. Weighing and drying is not necessary.

10.7.4 Perform the following steps rapidly to avoid loss of the more volatile compounds.

10.7.5 Add the appropriate surrogate standard solution as per table 9.8 to all samples, spiked samples, QC samples, and blanks.

10.7.6 For the quality control samples in each batch selected for spiking (Spiked blanks, matrix spikes), add the appropriate matrix spiking solution as per Table 9.8.

10.8 **High level concentration of organics (> 20 mg/kg) expected:**

10.8.1 Weigh out approximately 2 g of wet weight soil into a tarred 150-ml beaker and record the weight to the nearest 0.1-g. Samples that do not have a free flowing texture (sandy) are mixed with approximately 4-g anhydrous sodium sulfate to form a free flowing mixture. Select a sample to be weighed in triplicate for the batch matrix spike and matrix spike duplicate.

10.8.2 Weigh out 2 grams of anhydrous sodium sulfate into each of two, clean 150ml beakers to be used as the method blank and spiked blank. An empty beaker is used as a method blank and spiked blank and should be treated as a sample starting with 10.9.

10.8.3 Wipe samples are transferred to the extraction beaker. Weighing and drying is not necessary.

10.8.4 Add the appropriate surrogate standard solution as per table 9.8 to all samples, spiked samples, QC samples, and blanks.

10.8.5 For the sample in each batch selected for spiking, add the appropriate matrix spiking solution as per table 9.8.

10.8.6 Immediately add sufficient volume of methylene chloride/acetone to bring the volume to 10.0 ml considering the volume added of surrogates and spiking solution.

10.8.7 Sonicate with the 1/8 inch microtip ultrasonic probe for 2 min at an output of 5 and 50% duty cycle.

10.8.8 Filter the sample through 2-3 cm of glass wool in a pasteur pipette. If the sample does not require further concentration collect the entire sample and seal the container, or proceed to perform clean up procedures as appropriate.

10.8.9 If the sample requires further concentration, collect a known amount of extract, i.e. 5 ml and concentrate to a final volume of 0.5 ml using the nitrogen blowdown technique in section 10.15.

10.9 Add 100 ml of methylene chloride/acetone to each beaker under the hood.

10.10 The sonicator must be tuned per manufacturer's instructions prior to each day's use.

10.11 The extractor horns for the low concentration and high concentration protocols are not interchangeable.

10.11.1 For low level place the tip of a ¾-inch disruptor horn about ½-inch below the solvent surface but above the sample. Sonicate each sample for three minutes at 50% duty cycle and an output of 10. Check with your supervisor on how to make adjustments.

10.11.2 For medium/high level place the tip of a 1/8-inch tapered microtip.about ½-inch below the solvent surface but above the sample. Sonicate each sample for two minutes at 50% duty cycle and an output of 5. Check with your supervisor on how to make adjustments.

10.12 Prepare a drying funnel by adding approximately 30-g of baked sodium sulfate into a funnel. Place a prepared Kudema Danish apparatus under the column to collect the sample extract. Take the sample extract contained in the 250-ml beaker and pour it into the top of the drying funnel through a funnel containing filter paper and sodium sulfate. Make sure all apparatus is labeled accordingly.

10.12.1 The K-D apparatus can be set up with a concentrator tube or a Class A volumetric vessel.

10.13 Add a second 100-ml volume of methylene chloride/acetone to beakers and sonicate a second time. Decant the extract into the same drying column and combine the extracts in the K-D flask. Perform a third extraction in the same manner.

10.14 After the final extract has passed through the sodium sulfate column, rinse down the funnel and inside of the column with an excess of 30-ml of solvent. Add a glass boiling bead to the K-D flask and attach a three-ball Snyder column, prime the Snyder column by adding 1 ml of methylene chloride to the top.

10.15 SW8270D & SW8100: Position the K-D concentrator setup on the hot water bath with only the 10-ml concentrator tube submersed in the water. Evaporate the extract to about 1-ml not allowing it to go to dryness. Remove the K-D apparatus from the bath and allow the solvents

condensed in the Snyder column to drip back down into the concentrator tube. Allow the solvent to cool for approximately 10 minutes, then remove the Snyder column and K-D flask while rinsing the connector joints with 1 ml of methylene chloride. Since the volume is now greater than 1 ml, concentrate by directing a gentle stream of nitrogen gas over the extract surface to under 1-ml.

10.16 ALTERNATE CONCENTRATION PROCEDURE, SW8270D & SW8100: TurboVap Solvent Concentration. Place the sodium sulfate column onto the top of a TurboVap concentrator tube. Take the sample extract contained in the 150-ml beaker and pour it into the top of the drying funnel through a funnel containing filter paper and sodium sulfate following steps 10.12 – 10.15. Position the concentrator tube on TurboVap workstation. Immersing the tube nipple into the waterbath. Set the bath temperature for the solvent system in the concentrator tube. Methylene chloride: 40-45°C, methylene chloride/acetone: 55-60°C. Select volume setpoint for 1ml and initiate the volume reduction procedure. Proceed to step 10.19.

Note: This procedure is not normally used for soils, but may be employed in case of equipment malfunctions, or overload.

10.17 Solvent Exchange – Kuderna Danish (SW8081B, SW8082A & SW 8310)

10.17.1 If a solvent exchange is required (methods 8081B, 8082A require exchange to hexane, method 8310 requires acetonitrile), momentarily remove the Snyder column, add 50 ml of the exchange solvent, a new boiling chip, and reattach the Snyder column. Alternatively, pour the exchange solvent into the top of the Snyder column while the concentrator remains on the water bath. Concentrate the extract, as described in Sec. 10.15, raising the temperature of the water (85 ± 5°C for hexane) bath to maintain proper distillation.

10.17.2 Remove the Snyder column and rinse the flask and its lower joints into the concentrator tube with 1 - 2 ml of hexane. If sulfur crystals are a problem, proceed to EOP011 for cleanup. The extract may be further concentrated by using the technique outlined in Sec. 10.18 or adjusted to 10.0 ml with the solvent last used. Proceed to step 10.24.

10.18 Solvent Exchange – TurboVap Concentrator (SW8081B,SW8082A & SW8310). If a solvent exchange is required (methods 8081, 8082 require exchange to hexane, Method 8310 requires acetonitrile), pour 50 ml of the exchange solvent into the concentrator tube after the initial concentration to 1ml. Concentrate the extract, as described in Sec. 11.16, raising the temperature of the water bath to 60 ± 5°C for hexane. Take TurboVap concentrator tube out after it reaches 1 ml and add 9 ml of Hexane to adjust to the final volume of 10 ml. Proceed to step 10.23 for SW8082A or step 10.24 for SW8081B.

10.19 Employ steps 10.20 through 10.22 for SW8100 and SW8270D.

10.20 Remove the K-D apparatus from the bath and allow the solvent condensed in the Snyder column to drip back down into the concentrator tube. Allow the solvent to cool for approximately 10 minutes, then remove the Snyder column and K-D flask while rinsing each connector joint with 1 ml of methylene chloride or hexane

10.21 Since the volume is now greater than 1 ml, concentrate using an N-Evap nitrogen concentrator. Immerse the concentrator tube into the water bath of the N-Evap, which is maintained at 35°C. Direct a gentle stream of nitrogen gas over the extract surface and evaporate the solvent until the desired volume is reached. Occasionally rinse the side- walls of the concentrator tubes with methylene chloride during the final evaporation step.

10.22 Final Volume Adjustments.

10.22.1 If a K-D apparatus with a Class A collection vessel was used to concentrate the sample, adjust the volume to 1-ml directly in the vessel with the solvent last used. Transfer the extract to a 2-ml crimp vial using a Pastuer pipette. Label the vial with sample number and batch number. Protect the extracts from light and store them in the extract freezer at –10°C.

10.22.2 If a K-D apparatus with a concentrator tube (not Class A) was used to concentrate the sample, transfer the extract to a **1ml** Class A volumetric vessel or flask with a Pastuer pipette. Adjust the volume to 1ml with the solvent last used. Label a 2-ml crimp vial with the sample number and batch number. Transfer the extract to the 2- ml crimp vial with a new Pastuer pipette. Label the vial with sample number and batch number. Protect the extracts from light and store them in the extract freezer at –10°C.

10.22.3 If the TurboVap apparatus was used, transfer the extract to a 1ml Class A volumetric vessel or flask with a Pastuer pipette. Adjust the volume to 1ml with the solvent last used. Label a 2-ml crimp vial with the sample number and batch number. Transfer the extract to the 2- ml crimp vial with a new Pastuer pipette. Label the vial with sample number and batch number. Protect the extracts from light and store them in the extract freezer at –10°C.

10.23 Sulfuric Acid Cleanup (Required for PCB analysis using SW8082A)

10.23.1 Transfer 2-ml of the extract to a Teflon screw cap 4-ml vial, which contains 2-ml of pure sulfuric acid. Shake vigorously for 1 minute using a touch mixer. The Method Blank and Spike Blank must also undergo this cleanup

10.23.2 Proceed to 10.24.

10.24 Copper Clean-Up

10.24.1 Transfer the extract to a 2-ml Teflon lined crimp vial that contains activated copper. Shake vigorously for 2 minutes and allow settling for 5 minutes. The copper cleanup is performed to remove sulfur contamination and can be repeated to further cleanup the extract. A black precipitate indicates that sulfur is present in the sample. The Method Blank and Spike Blank must also undergo this cleanup.

10.25 Store the vials by batch in the refrigerator located in the extraction laboratory. Protect the extracts from light and refrigerate them at 4°C.

11.0 Calculations

11.1 Not applicable.

12.0 QC Requirements

12.1 A method blank and blank spike is required on each day of extraction or every 20 samples, whichever is more frequent.

12.2 A matrix spike/ matrix spike duplicate is required per 20 samples.

12.3 A separate BSP and MS/MSD set are needed if the sample requires PCBs, Toxaphene and/or chlordane. Therefore, if a sample is to be extracted for pesticides and PCBs, 2 sets of MS/MSDs and BSP are needed.

12.4 Refer to Project Specific Bench Notes(GC8081, GC8082, MS8270) for additional program or client specific QC requirements.

13.0 Documentation

13.1 All the information required by the extraction logbooks must be completed.

13.2 All standards preparation must be documented in the standards preparation logbook.

13.3 Equipment maintenance logs must be maintained.

13.4 A record of the daily sonicator tune is recorded in the sonicator tuning log.

14.0 Data Review And Reporting

14.1 The sample prep supervisor reviews all extraction log information for completeness and accuracy prior to the release of sample extracts for analysis,

14.2 The supervisor updates the sample status in the LIMS upon completion of the extraction.

15.0 Pollution Prevention & Waste Management

15.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 15.2.

15.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, EHS004. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:

15.2.1 Non hazardous aqueous wastes
15.2.2 Hazardous aqueous wastes
15.2.3 Chlorinated organic solvents
15.2.4 Non-chlorinated organic solvents
15.2.5 Hazardous solid wastes

15.2.6 Non-hazardous solid waste

Accutest Laboratories
Standard Operating Procedure

Lab Manager: _____

QA Manager: _____

Effective Date: 12/15/2010

TEST NAME: PRESSURIZED FLUID EXTRACTION (ASE)

METHOD REFERENCE: SW 846 3545A, Revision 1, February 2007

Revised Sections: *1.1, 1.2, Table 1, Added Section 10.7*

1.0 SCOPE AND APPLICATION

1.1 Method 3545A is used for extracting water insoluble or slightly water soluble semivolatile organic compounds from soils, clays, sediments, sludges, waste solids, and biota. It is applicable to the extraction of base, neutral, and acid semivolatile organic compounds, PAH's organophosphorus pesticides, organochlorine pesticides, chlorinated herbicides, and PCBS. The method uses elevated temperature (100^{0}C) and pressure (1500 psi) to achieve analyte recoveries equivalent to those from Soxhlet extraction, using less solvent and taking significantly less time than the Soxhlet procedure. Method 3545A is applicable to solid samples only, and is most effective on dry materials with small particle sizes.

1.2 This method is primarily used with methods 8015B, 8081, 8082. Methods 8270, 8100, 8310 and 8151 use sonication (EOP003).

2.0 SUMMARY

2.1 Samples are prepared for extraction either by mixing the sample with pelletized diatomaceous earth. The sample is then ground to a 100 - 200 mesh powder (150 um to 75 um) and loaded into the extraction cell. The extraction cell containing the sample is heated to the extraction temperature, pressurized with the appropriate solvent system, and extracted for a fixed time period. The solvent systems employed are based on the appropriate solvents used for the analytes of interest and the matrix being extracted.

2.2 The solvent is collected from the heated extraction vessel and allowed to cool. The extract is concentrated, if necessary, and prepared for analysis based on the requirements of the determinative analytical finish being employed.

3.0 REPORTING LIMIT AND METHOD DETECTION LIMIT

3.1 See determinative method.

4.0 DEFINITIONS

BLANK - an analytical sample designed to assess specific sources of laboratory contamination. See individual types of Blanks: Method Blank; Instrument Blank, Storage Blank, and Sulfur Blank.

CLASS A GLASSWARE – Volumetric laboratory glassware that has been manufactured, calibrated and certified to established ASTM volume standards. Class A Glassware does not require volume calibration or verification.

CONTINUOUS LIQUID-LIQUID EXTRACTION - used herein synonymously with the terms continuous extraction, continuous liquid extraction, and liquid extraction. This extraction technique involves boiling the extraction solvent in a flask and condensing the solvent above the aqueous sample. The condensed solvent drips through the sample, extracting the compounds of interest from the aqueous phase.

INTERNAL STANDARDS - compounds added to every standard, blank, matrix spike, matrix spike duplicate, sample (for volatiles), and sample extract (for semivolatiles) at a known concentration, prior to analysis. Internal standards are used as the basis for quantitation of the target compounds.

MATRIX - the predominant material of which the sample to be analyzed is composed. For the purpose of this SOW, a sample matrix is either water or soil/sediment. Matrix is not synonymous with phase (liquid or solid).

MATRIX SPIKE - aliquot of a matrix (water or soil) fortified (spiked) with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery.

MATRIX SPIKE DUPLICATE - a second aliquot of the same matrix as the matrix spike (above) that is spiked in order to determine the precision of the method.

METHOD BLANK - an analytical control consisting of all reagents, internal standards and surrogate standards (or SMCs for VOA), that is carried throughout the entire analytical procedure. The method blank is used to define the level of laboratory, background and reagent contamination.

PERCENT DIFFERENCE (%D) - As used in this SOW and elsewhere to compare two values, the percent difference indicates both the direction and the magnitude of the comparison, i.e., the percent difference may be either negative, positive, or zero. (In contrast, see relative percent difference.)

PERCENT MOISTURE - an approximation of the amount of water in a soil/sediment sample made by drying an aliquot of the sample at 105°C. The percent moisture determined in this manner also includes contributions from all compounds that may volatilize at or below 105 °C, including water. Percent moisture may be determined from decanted samples and from samples that are not decanted.

REAGENT WATER - water in which an interferant is not observed at or above the minimum quantitation limit of the parameters of interest.

RECONSTRUCTED ION CHROMATOGRAM (RIC) - a mass spectral graphical representation of the separation achieved by a gas chromatograph; a plot of total ion current versus retention time.

5.0 HEALTH & SAFETY

5.1 The analyst must follow normal safety procedures as outlined in the Accutest Laboratory Safety Manual which includes the use of safety glasses and lab coats. In addition, all acids are corrosive and should be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical should be treated as a potential health hazard. Exposure to these reagents should be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets should be made available to all personnel involved in these analyses.

5.3 The following analytes covered by this method have been tentatively classified as known or suspected, human or mammalian carcinogens: benzene, carbon tetrachloride, chloroform, and vinyl chloride. Primary standards of these toxic compounds should be prepared in a hood. A NIOSH/Mass approved toxic gas respirator should be worn when the analyst handles high concentrations of these toxic compounds.

6.0 INTERFERENCES

6.1 Solvents, reagents, glassware, stainless steel extraction cell and other sample processing hardware may yield artifacts and/or interferences to sample analysis. All these materials must be demonstrated to be free from interferences under the conditions of the analysis by analyzing method blanks. Specific selection of reagents and purification of solvents by distillation in all-glass systems may be necessary. Refer to each method for specific guidance on quality control procedures and to Chapter Four for guidance on the cleaning of glassware.

6.2 Interferences coextracted from the samples will vary considerably from source to source. If analysis of an extracted sample is prevented due to interferences, further cleanup of the sample extract may be necessary. Refer to Method SW 846 3600 for guidance on cleanup procedures.

6.3 Phthalate esters contaminate many types of products commonly found in the laboratory. Plastics, in particular, must be avoided because phthalates are commonly used as plasticizers and are easily extracted from plastic materials. Serious phthalate contamination may result at any time if consistent quality control is not practiced. Soap residue (e.g. sodium dodecyl sulfate), which results in a basic pH on glassware surfaces, may cause degradation of certain analytes.

7.0 REAGENTS

7.1 Organic free reagent water prepared to the specifications of SW846 Chapter One.

7.2 Drying Agents

7.2.1 Pelletized diatomaceous earth.

7.2.2 Optional: Sodium sulfate (granular anhydrous)

7.2.3 Drying agents must be pre-cleaned or by Soxhlet extraction using the solvent system employed for samples followed by heating at 400°C for 4 hours in a shallow tray.

7.3 Sand, 10% HCl and deionized water washed, fired and or muffled at 600°C prior to use.

7.4 Solvents.

7.4.1 Organochlorine pesticides Analysis: Pesticide Grade, acetone/hexane (1:1, v/v) or acetone/methylene chloride (1: l,v/v)

7.4.2 Semivolatile organics Analysis: Pesticide Grade, acetone/hexane (1:1, v/v) or acetone/methylene chloride (1: l,v/v)

7.4.3 PCBs Analysis: Pesticide Grade, acetone/hexane (1:1, v/v) or acetone/methylene chloride (1: l,v/v)

7.4.4 Organophosphorus pesticides Analysis: Pesticide Grade methylene chloride, or acetone/methylene chloride (1: 1, v/v)

7.4.5 Chlorinated herbicides Analysis: Pesticide Grade acetone/methylene chloride/phosphoric acid solution (250:125:15, v/v/v), or acetone/methylene chloride/trifluoroacetic acid solution (250:125:1, v/v/v),. (if trifluoroacetic acid solution is used, prepare by mixing 1% trifluoroacetic acid in acetonitrile.) Make fresh solutions before each batch of extractions. Phosphoric acid solution Prepare a 1:1 (v/v) solution of 85% phosphoric acid in organic-free reagent water.

7.4.6 CAUTION: For best results with very wet samples (e.g., ≥30% moisture), reduce or eliminate the quantity of hydrophilic solvent used.

7.5 Nitrogen, high-purity.

7.6 Surrogate Standard Solutions

7.6.1 Pesticide / PCB Surrogates: 400ppm solution in Acetone (Tetrachloro-meta-xylene, Decachlorobiphenyl).

7.6.2 BN Surrogates: 100ppm solution in acetone(2-Fluorobiphenyl, Nitrobenzene-d_5, Terphenyl-d_{14}).

7.6.3 Acid Surrogates: 100ppm solution in acetone (Phenol-d_5, 2-Fluorophenol, 2,4,6 Tribromophenol).

7.6.4 DRO Surrogates: 50 ppm solution in acetone (o-Terphenyl, Tetracosane-d50, 5α Androstane)

7.6.5 PAH Surrogates Method 8100: 100ppm solution in acetone(2-Fluorobiphenyl, Nitrobenzene-d_5, Terphenyl-d_{14}).

7.6.6 PAH Surrogates Method 8310:10 ppm solution in acetone (p-Terphenyl and o-Terphenyl)

7.7 Target Compound Spiking Solutions.

7.7.1 Pesticide Target Compounds: 250ppb solution (Priority pollutants & Target compound list). Toxaphene 5 ppm and Chlordane 4 ppm if required

7.7.2 PCBs target Compounds: 2ppm solution in acetone (Aroclors 1016, 1260)

7.7.3 BN Target Compounds: Full list - 100 ppm in acetone (Priority pollutants & Target compound list).

7.7.4 Acid Target Compounds:, Full list - 100 ppm in acetone (Priority pollutants & Target compound list).

7.7.5 DRO Target Compounds 1000 ppm in acetone (DRO Spiking Solutions)

7.7.6 PAH Target Compounds Method 8100: 10 ppm in acetone (PAH Target Compounds)

7.7.7 PAH Target Compounds Method 8310: 10 ppm in acetone (PAH Target Compounds + 1&2 Methylnaphthalene)

8.0 APPARATUS

8.1 Dionex pressurized fluid extraction device (Accelerated Solvent Extractor) with 11ml, 22ml, and 33ml stainless steel extraction cells to accommodate 10-g, 20-g and 30-g samples respectively.

8.1.1 Extraction cells must be cleaned following each use. Dis-assemble the cell and discard the extracted sample in an environmentally conscious manner. Rinse the cell caps with deionized water. Also rinse the cell body with deionized water while removing any residual solids with a tube brush. Rinse the entire apparatus, first with acetone, then with methylene chloride. Thoroughly dry the device prior to loading the sample.

8.2 Mortar and pestle, capable of reducing dried sample particle size to <1mm.

8.3 Analytical balance - capable to weighing to 0.01 g.

8.4 40-mL and 60-mL, pre-cleaned, extract collection vials (IChem) with open top, screw-cap and PTFE-lined silicone septum.

8.5 Whatman glass fiber filter disk - 1.91 cm, (PN-18219356).

8.6 Dionex PEEK seal cell cap disks (PN-49454,49455).

8.7 Sieves, # 10 mesh and #1 mesh.

8.8 Class A volumetric flasks 1ml and 10 ml

9.0 PROCEDURE

9.1 Sample preparation

9.1.1 Sediment/soil samples - Decant and discard any water layer on a sediment sample. Mix the sample thoroughly, especially composited samples. Discard any foreign objects such as sticks, leaves, and rocks. Mix the sample with pre-extracted diatomaceous earth (DE) according to the following proportions:

Sample Weight	Weight DE
10 gram - Dry	2 grams
10 gram - Wet	3 grams
15 gram - Dry	3 grams
15 gram - Wet	4 grams

9.1.2 Mix until a free-flowing powder is obtained. Do not use the sodium sulfate option with polar solvents. Sodium sulfate will dissolve in pressurized, heated, polar solvents and re-crystallize in the transfer lines of the apparatus.

9.1.3 Spike the sample with the appropriate surrogate solutions, and, if necessary, target compound solutions.

9.1.3.1 Pesticide / PCB Surrogates: 1ml of the 400ppb solution.

9.1.3.2 Pesticide Target Compounds: 1ml of the 250ppb solution. 1ml of 5 ppm Toxaphene or 1ml of 4 ppm Chlordane if required

9.1.3.3 PCBs: 1ml of the 2ppm Aroclor solution

9.1.3.4 BN Surrogates: 0.5ml of the 100ppm surrogate solution.

9.1.3.5 Acid Surrogates: 0.5ml of the 100ppm surrogate solution.

9.1.3.6 BN Target Compounds: 0.5ml of the 100ppm solution.

9.1.3.7 Acid Target Compounds: 0.5ml of the 100ppm solution.

9.1.3.8 DRO Surrogates: 1.0 ml of the 50ug/ml surrogate solution.

9.1.3.9 DRO Target Compounds 1.0 ml of the 1000 ppm solution.

9.1.3.10 PAH Method 8100 Surrogates: 1.0 ml of the 100 ppm solution.

9.1.3.11 PAH Method 8100 Target Compounds: 1.0 ml of the 10 ppm solution.

9.1.3.12 PAH Method 8310 Surrogates: 1.0 ml of the 10 ug/ml solution.

9.1.3.13 PAH Method 8310 Target Compounds: 1.0 ml of the 10 ppm solution.

9.1.4 Grind or otherwise reduce the particle size of the waste so that it either passes through a 1-mm sieve or can be extruded through a 1-mm hole using a mortar and pestle. The grinding apparatus must be decontaminated between each sample with soap and water, followed by acetone and hexane rinses.

9.2 NOTE: The note in Sec. 9. 1.1 also applies to the grinding process.

9.3 Grind a sufficient weight of the dried sample from Sec. 9.1 to yield the sample weight needed for the determinative method (usually 10 - 15 g). Grind the sample until it passes through a 10 mesh sieve.

9.4 Transfer the ground sample to an extraction cell of the appropriate size for the aliquot. Use an 11-mL cell for 10g aliquots, a 22-mL cell for 20g aliquots, and a 33-mL cell for 30g aliquots. The weight of a specific sample that a cell will contain depends on the bulk density of the sample and the amount of drying agent that must be added to the sample in order to make it suitable for extraction. Analysts should ensure that the sample aliquot extracted is large enough to provide the necessary sensitivity and choose the extraction cell size accordingly.

9.5 Place a Whatman GF/B, 1.91 cm glass fiber filter in the cell outlets. Fill any extraction cell volume voids with clean sand.

9.6 Place the extraction cell into the instrument or auto-sampler carrousel.

9.7 Place a pre-cleaned 60ml IChem collection vial into the collection vial carousel for each sample extracted. The collection vessel carousel number corresponds to the carousel number of the extraction cell. The total volume of the collected extract will depend on the extraction procedure employed and may range from 0.5 to 1.4 times the volume of the extraction cell. Ensure that the collection vessel is sufficiently large to hold the extract.

9.8 Extraction Parameters. Select the appropriate extraction parameters from Table 1, dependent upon the parameters of interest and enter them into the method screen of the instrument micro-computer. Save the operating parameters under an assigned method

number and employ these operating parameters when sample matrices of this type are extracted for the target parameters of interest.

Table 1.
Accelerated Solids Extraction
Operating Parameters for Selected Analysis

BNAs

Solvent:	Methylene Chloride : Acetone
Temperature:	100°C.
Pressure:	1500 PSI
Static Time:	5 Min
Flush Volume:	60%
Purge Time:	60 seconds
Static Cycles:	1
Oven Heatup	5 Min

PAH's

Solvent:	Methylene Chloride : Acetone
Temperature:	100°C.
Pressure:	1500 PSI
Static Time:	5 Min
Flush Volume:	60%
Purge Time:	60 seconds
Static Cycles:	1
Oven Heatup:	5 Min

Chlorinated Pesticides

Solvent:	Methylene Chloride : Acetone
Temperature:	100°C.
Pressure:	1500 PSI
Static Time:	5 Min
Flush Volume:	60%
Purge Time:	60 seconds
Static Cycles:	1
Oven Heatup	5 Min

PCB's

Solvent:	Methylene Chloride : Acetone
Temperature:	100°C.
Pressure:	1500 PSI
Static Time:	5 Min
Flush Volume:	60%
Purge Time:	60 seconds
Static Cycles:	1
Oven Heatup	5 Min

DRO

Solvent:	Methylene Chloride : Acetone
Temperature:	100°C.
Pressure:	1500 PSI
Static Time:	5 Min
Flush Volume:	60%
Purge Time:	60 seconds
Static Cycles:	1
Oven Heatup	5 Min

Chlorinated Herbicides

Solvent:	Methylene Chloride : Acetone
Temperature:	100°C.
Pressure:	1500 PSI
Static Time:	5 Min
Flush Volume:	60%
Purge Time:	60 seconds
Static Cycles:	1
Oven Heatup	5 Min

Table 1 (cont'd)

PCBs in Fish tissue

Solvent:	Methylene Chloride : Acetone
Temperature:	100°C.
Pressure:	1500 PSI
Static Time:	5 Min
Flush Volume:	60%
Purge Time:	60 seconds
Static Cycles:	1
Oven Heatup	5 Min

9.9 Initiate the extraction cycle by first loading the method and extraction schedule from the load method screen and pushing the enter key. When this step has been completed, push the start key to initiate the extraction sequence.

9.10 Collect each extract in a clean vial (see Sec. 9.6). Allow the extracts to cool after the extractions are complete.

9.11 Residual Water Removal. Prepare a sodium sulfate column in a small glass funnel. Pre-rinse the sodium sulfate with methylene chloride. pass the sample extract through the sodium sulfate, removing the co-extracted water. Collect the extract in an In-line Kuderna-Danish equipped with a jacketed concentrator tube.

9.12 The extract is now ready for concentration, cleanup, or analysis, depending on the extent of interferants and the determinative analytical finish to be employed. Excess water present in extracts may be removed by filtering the extract through a bed of anhydrous sodium sulfate. Refer to EOP 002 for detailed procedures.

9.13 If the phosphoric acid solution is used for the extraction of chlorinated herbicides, then the extractor should be rinsed by pumping acetone through all the lines of the system. The use of other solvents for these analytes may not require this rinse step.

10.0 QUALITY CONTROL

10.1 Reagents. All reagents used in the extraction process are carefully controlled by maintaining accurate records of purchase dates, opening dates, and shelf life. Any reagent that either contains interfering compounds or becomes contaminated with interfering compounds must be immediately discard and replaced with a lot which satisfies the interference free criteria.

10.2 Method Blank. Each extraction batch must contain a method blank that demonstrates that all parts of the equipment in contact with the sample and reagents are interference-free. This is accomplished through the analysis of a solid matrix method blank (e.g., clean sand). Each time samples are extracted, and when there is a change in reagents, a method blank needs to be extracted and analyzed for the compounds of interest. The method blank is processed through the extraction and analytical finish steps.

10.3 If the equipment or reagents contains interferences or target parameters which affect the analysts ability to report reliable data, the analysis must be immediately stopped and the source of contamination identified and eliminated before continuing with sample extraction.

10.4 A laboratory control spike (LCS) is extracted and analyzed with each batch of samples. LCS accuracy is used to determine if out of control performance on matrix spike/matrix spike duplicate samples is attributed to matrix effects. If the MS/MSD is out of control and the LCS is in control, matrix effects are attributed to the poor MS/MSD accuracy. If the LCS is out of control, then the laboratory is out of control and all sample analysis must be repeated.

10.5 A matrix spike or matrix spike/matrix spike duplicate (MS/MSD) samples must be extracted and analyzed with each batch of samples prepared by this procedure. The accuracy values for each compound are compared to the control limit values. If the results indicate an out of control situation, the performance of each individual compound in the MS/MSD is compared to the individual accuracy in the laboratory control spike. If the laboratory control spike accuracy is within control, the out of control MS/MSD performance is attributed to matrix related issues and the client is given the option of requesting repeat analysis.

10.6 Surrogate standards are added to all samples and quality control samples. Surrogate accuracy is monitored to determine if the analysis is in control. If surrogate accuracy falls outside the control limits, and attempts to determine the reasons for the out of control event are unsuccessful, the extraction must be repeated to verify either matrix affects or extraction error.

10.7 Refer to Project Specific Bench Notes(GC8081, GC8082, MS8270) for additional program or client specific QC requirements.

11.0 DOCUMENTATION

11.1 All the information required in the extraction logbooks must completed.

11.2 All standards preparation must be documented in the standards preparation logbook.

11.3 Equipment maintenance logs must be maintained.

12.0 DATA REVIEW & REPORTING

Not applicable.

13.0 POLLUTION PREVENTION & WASTE MANAGEMENT

13.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed.

13.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, EHS004. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:

13.2.1 Non hazardous aqueous wastes.

13.2.2 Hazardous aqueous wastes

13.2.3 Chlorinated organic solvents

13.2.4 Non-chlorinated organic solvents

13.2.5 Hazardous solid wastes

13.2.6 Non-hazardous solid wastes

14.0 REFERENCES

14.1 B. Richter, Ezzell, J., and Felix, D., "Single Laboratory Method Validation Report. Extraction of TCL/PPL (Target Compound List/Priority Pollutant List) BNAs and Pesticides using Accelerated Solvent Extraction (ASE) with Analytical Validation by GC/MS and GC/ECD"; Document 116064.A, Dionex Corporation, June 16, 1994.

14.2 B Richter, Ezzell, J., and Felix, D., "Single Laboratory Method Validation Report. Extraction of TCL/PPL (Target Compound List/Priority Pollutant List) OPPS, Chlorinated Herbicides and PCBs using Accelerated Solvent Extraction (ASE)". Document 101 124, Dionex Corporation, December 2, 1994).

14.3 United States Environmental Protection Agency, "Method 3545A: Pressurized Fluid Extraction", Test Methods for Evaluating Solid Wastes, SW846 Final Update IV: Laboratory Manual, Physical/Chemical Methods, Revision 1, February 2007.

ACCUTEST LABORATORIES
Standard Operating Procedure

Lab Manager

QA Manager

Effective Date: 12/15/2010

TEST NAME DETERMINATION OF ORGANOCHLORINE PESTICIDES USING GC SYSTEM

METHOD REFERENCE SW846 8081B (Revision 2, February 2007)

Revised sections: Table 2, 3.2, Added Section 13.9

1.0 SCOPE AND APPLICATION

1.1 This SOP describes the analytical procedures, which are utilized by Accutest to acquire samples for analysis of organochlorine pesticides and screening of polychlorinated biphenyls (PCBs) by gas chromatography with Electron Capture Detectors (ECD).

1.2 The method is applicable to extracts from solid and liquid matrices. The compounds listed in Table 1 are determined by a dual-column analysis system.

2.0 SUMMARY OF METHOD

2.1 A measured volume or weight of sample (approximately 1 L for liquids, 15 g for solids) is extracted using the appropriate matrix-specific sample extraction technique. Liquid samples are extracted at neutral pH with methylene chloride using Method 3510 (separatory funnel). Solid samples are extracted using Method 3545A, Pressurized Fluid Extraction or Method 3550C, Sonication. A variety of cleanup steps may be applied to the extract, depending on the nature of the matrix interferences and the target analytes. Cleanups include Florisil (Method 3620), silica gel (Method 3630), gel permeation chromatography (Method 3640), and sulfur (Method 3660).

2.2 After cleanup, the extract is analyzed by injecting a 2-µL sample that is split between dual narrow-bore fused silica capillary columns that are mounted in a single gas chromatograph with electron capture detectors (GC/ECD).

2.3 The peaks detected are qualitatively identified by comparison to retention times specific to the known target list of compounds on two different column types (primary and confirmation).

2.4 If sensitivity permits, the positive hit should be confirmed by GC/MS method 8270D.

2.5 Once identified the compound is quantitated by external standard techniques with an average calibration factor generated from a calibration curve.

3.0 REPORTING LIMIT & METHOD DETECTION LIMIT

3.1 Reporting Limit. The reporting limit for this method is established at the lowest concentration standard in the calibration curve. RL's may vary depending on matrix and sample volumes or weight and percent moisture. Refer to Table 1 for current reporting limits.

3.2 Method Detection Limit. Experimentally determine MDLs using the procedure specified in 40 CFR, Part 136, Appendix B. This value represents the lowest reportable concentration of an individual compound that meets the method qualitative identification criteria.

3.2.1 Experimental MDLs must be determined annually for this method.

3.2.2 Process all raw data for the replicate analysis in each MDL study. Forward the processed data to the QA group for archiving.

4.0 DEFINITIONS

BLANK - an analytical sample designed to assess specific sources of laboratory contamination. The different types of blanks are Method Blank, Instrument Blank, Storage Blank, and Sulfur Blank.

FIELD BLANK – an analytical sample prepared from organic-free water and carried through the sampling handling protocol serves as a check for contamination.

CALIBRATION FACTOR (CF) - a measure of the gas chromatographic response of a target analyte to the mass injected. The calibration factor is analogous to the Relative Response Factor (RRF) used in the Volatile and Semivolatile fractions.

CONTINUING CALIBRATION - analytical standard run every 12 hours and at the end of analytical sequence to verify the initial calibration of the system.

CONTINUOUS LIQUID-LIQUID EXTRACTION - used herein synonymously with the term's continuous extraction, continuous liquid extraction, and liquid extraction. This extraction technique involves boiling the extraction solvent in a flask and condensing the solvent above the aqueous sample. The condensed solvent drips through the sample, extracting the compounds of interest from the aqueous phase.

INITIAL CALIBRATION - analysis of analytical standards for a series of different specified concentrations; used to define the linearity and dynamic range of the response of the electron capture detector to the target compounds.

MATRIX - the predominant material of which the sample to be analyzed is composed. A sample matrix is either water or soil/sediment. Matrix is not synonymous with phase (liquid or solid).

MATRIX SPIKE - aliquot of a matrix (water or soil) fortified (spiked) with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery.

MATRIX SPIKE DUPLICATE - a second aliquot of the same matrix as the matrix spike (above) that is spiked in order to determine the precision of the method.

METHOD BLANK - an analytical control consisting of all reagents and surrogate standards that is carried throughout the entire analytical procedure. The method blank is used to define the level of laboratory, background and reagent contamination.

METHOD DETECTION LIMITS (MDLs) – The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. MDLs should be determined approximately once per year for frequently analyzed parameters.

PERCENT DIFFERENCE (%D) - to compare two values, the percent difference indicates both the direction and the magnitude of the comparison, i.e., the percent difference may be either negative, positive, or zero. (In contrast, see relative percent difference.)

PERCENT MOISTURE - an approximation of the amount of water in a soil/sediment sample made by drying an aliquot of the sample at 105°C. The percent moisture determined in this manner also includes contributions from all compounds that may volatilize at or below 105 °C, including water. Percent moisture may be determined from decanted samples and from samples that are not decanted.

REAGENT WATER - water in which an interferant is not observed at or above the minimum detection limit of the parameters of interest.

RELATIVE PERCENT DIFFERENCE (RPD) - to compare two values, the relative percent difference is based on the mean of the two values, and is reported as an absolute value, i.e., always expressed as a positive number or zero. (In contrast, see percent difference.)

RELATIVE RESPONSE FACTOR (RRF) - a measure of the instrument response of an analyte. Response Factors are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples.

RETENTION TIME (RT) - the time required (in minutes) for a standard compound to elute from a chromatographic column.

SURROGATES - for semivolatiles and pesticides/Aroclors, compounds added to every blank, sample, matrix spike, matrix spike duplicate, and standard; used to evaluate analytical efficiency by measuring recoveries. Surrogate are brominated, fluorinated, or isotopically labeled compounds not expected to be detected in environmental media.

INSTRUMENT BLANK - a system evaluation sample containing lab reagent grade water with internal standards and/or surrogate standards added. An instrument blank is used to remove and/or evaluate residual carryover from high level standards, spike samples and field samples.

5.0 HEALTH & SAFETY

5.1 The analyst must follow normal safety procedures as outlined in the Accutest Health and Safety Plan and Personal Protection Policy, which includes the use of safety glasses and lab coats. In addition, all acids are corrosive and must be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical must be treated as a potential health hazard. Exposure to these reagents should be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets must be made available to all personnel involved in these analyses.

5.3 The following analytes covered by this method have been tentatively classified as known or suspected, human or mammalian carcinogens: 4,4'-DDT, 4,4'-DDD, and the BHCs. Primary standards of these toxic compounds should be prepared in a hood. A NIOSH/Mass approved toxic gas respirator should be worn when the analyst handles high concentrations of these toxic compounds.

6.0 INTERFERENCES

6.1 The data from all blanks, samples, and spikes must be evaluated for interferences.

6.2 Method interferences may be caused by contaminants in solvents, reagents, glassware, and other stages of sample processing. Refer to "The Preparation of Glassware for Extraction of Organic Contaminants" SOP for practices utilized in the extraction department.

6.3 Matrix interferences may be caused by contaminants that are co-extracted from the sample. The extent of matrix interferences will vary from source to source. Interferences such as sulfur and phthalate are treated with copper and alumina by organics preparation respectively.

6.3.1 The presence of elemental sulfur will result in broad peaks that interfere with detection of early-eluting organochlorine pesticides. Method 3660 is suggested for removal of sulfur.

6.3.2 Avoiding contact with any plastic materials and checking all solvents and reagents for phthalate contamination can best minimize interference from phthalate esters.

6.4 Waxes, lipids, and other high molecular weight materials can be removed by method-3640 (Gel Permeation Chromatography-GPC column cleanup).

6.5 To reduce carryover when high-concentration samples are sequentially analyzed, the syringe must be rinsed out between samples with solvent.

6.6 In the case where an unusually concentrated sample is encountered, it should be followed by the analysis of an instrument blank. An instrument blank is a sample containing hexane with surrogate standards added at 20 ppb. An instrument blank is used to remove and/or evaluate residual carryover from high level standards, spike samples and field samples.

7.0 SAMPLE PRESERVATION AND HOLDING TIME

7.1 PRESERVATION

7.1.1 Water Samples

7.1.1.1 Collect samples in 1 liter glass amber bottles without preservatives.

7.1.1.2 A liter of an unpreserved sample is required for extraction. Additional sample volume is necessary for any samples used for matrix spike and matrix spike duplicates. Therefore, 3 liters of at least one sample in every group of 20 field samples are required for analysis to accommodate all quality control requirements.

7.1.2 Soil Samples

7.1.2.1 Samples are collected in a 300-ml amber glass sample bottle. No preservative is required.

7.1.3 Sample should be taken with care so as to prevent any portion of the collected sample coming in contact with the sampler's gloves, thus causing possible phthalate contamination.

7.1.4 The samples must be protected from light and refrigerated at ≤ 6 ^{0}C from the time of receipt until extraction and analysis.

7.2 HOLDING TIME

7.2.1 Aqueous sample must be extracted within 7 days of sampling.

7.2.2 Soil sample must be extracted within 14 days of sampling.

7.2.3 Extracts must be analyzed within 40 days following extraction.

8.0 APPARATUS AND MATERIALS

8.1 GAS CHROMATOGRAPH SYSTEM

8.1.1 Gas Chromatograph – Agilent or Hewlett Packard Models 6890 and 5890. The analytical system is completed with a temperature programmable gas chromatograph and all required accessories including syringes, capillary chromatographic columns, and gases. The capillary column is directly coupled to the source. The injection port is designed for splitless injection with capillary columns.

8.1.2 Columns

8.1.2.1 Column pair 1

8.1.2.1.1 30 m x 0.32 mm ID, 0.5 µm film thickness fused silica, DB-1701 narrow-bore capillary column or equivalent.

8.1.2.1.2 30 m x 0.32 mm ID, 0.5 µm film thickness fused silica, DB-5 narrow-bore capillary column.

8.1.2.2 Column pair 2

8.1.2.2.1 30 m x 0.32 mm ID, 0.5 µm film thickness fused silica, RTX CLPI narrow-bore capillary column or equivalent.

8.1.2.2.2 30 m x 0.32 mm ID, 0.25 µm film thickness fused silica, RTX CLPII narrow-bore capillary column or equivalent.

8.1.3 Detectors

8.1.3.1 Electron Capture Detectors (HP).

8.1.3.2 Micro Electron Capture Detectors (HP).

8.2 AUTOSAMPLER

8.2.1 Agilent or Hewlett Packard Model 7673A, 7683, 7643A capable of holding 100 of 2-ml crimp vials.

8.3 DATA SYSTEM

8.3.1 MSD iinterfaced to the gas chromatograph which allows the continuous acquisition and storage on machine-readable media (disc) of all chromatographic data obtained throughout the duration of the analysis.

8.3.2 The ENVIROQUANT (PC) data system is capable of quantitation using multipoint calibration.

8.3.3 Legato Networker with lookup database on 4mm DAT tape for long term, off line magnetic storage of data.

8.4 SYRINGES

8.4.1 Manually held ul graduated syringes, various volumes (Hamilton or equiv.).

8.4.2 10 µl graduated, auto sampler (Hamilton or equiv.).

8.5 VOLUMETRIC FLASKS, Class A.

9.0 REAGENTS AND STANDARDS

9.1 Refer to Accutest Sample Preparation SOPs EOP001 and EOP040A for reagents and standards used for sample extraction.

9.2 Solvents - Ultra pure, chromatography graded Hexane.

9.3 Stock Standard Solutions

9.3.1 Two separate sources of commercially prepared standards with traceability documentation are used.

9.3.1.1 Pesticides Mixtures containing one or more of the following compounds: alpha-BHC, beta-BHC, delta-BHC, gamma-BHC(Lindane), Heptachlor, Aldrin, Heptachlor Epoxide, Endosulfan I, Dieldrin, 4,4'-DDE, Endrin, Endosulfan II, 4,4'-

DDD, Endosulfan sulfate, 4,4—DDT, Methoxychlor, Endrin ketone, Endrin Aldehyde, alpha-Chlordane & gamma-chlordane.

9.3.1.2 Individual standards containing Toxaphene, Chlordane and Mirex.

9.4 Working Solutions

9.4.1 Prepare working solutions, using stock solution, in hexane, as needed, that contain the compounds of interest, either singly or mixed together. Refer to Table 3 for details.

9.5 Calibration Standards

9.5.1 Initial Calibration Standards

9.5.1.1 Calibration standards are prepared at a minimum of five concentrations, including surrogates, from the above working solutions. Suggested levels and preparations are shown in Table 4A.

9.5.1.2 Separate calibration standards are required for each multi-component target analyte (i.e., Toxaphene and Chlordane). Unless otherwise necessary for a specific project, such as Ohio VAP or the Dept. of Defense (DoD), a single calibration standard near the mid-point of the expected calibration range of each multi-component analyte is employed. Refer to Table 4B and 4C for preparation scheme. Optional curves as shown on Table 4D and 4E may also be used for a multi-point calibration per project's specification.

9.5.2 Continuing Calibration Verification (CCV)

9.5.2.1 Continuing calibration checks containing all the single-component analytes are prepared at concentrations of 10 µg/l, 25 ug/l and 50 µg/l as described in Table 5. During analysis, these alternate concentrations are run to check the initial calibration.

9.5.2.2 In situations where only Toxaphene or Chlordane is of interest for a specific project and for Ohio VAP multi-level calibration checks of each multi-component analyte of interest may be prepared and analyzed throughout the analytical sequence.

9.6 Initial Calibration Verification (ICV) - Second Source Calibration Check Standard

9.6.1 Prepare the ICV standards from separate sources of stock standards from the calibration curve following the procedures in Table 6A and 6B.

9.6.2 The ICV must be analyzed immediately following the initial calibration.

9.7 Surrogates

9.7.1 Tetrachloro-m-xylene (TCMX) and decachlorobiphenyl (DCB) are used as surrogate standards for this method.

9.7.2 A calibration range must be constructed for the surrogate compounds. Accordingly, appropriate amounts of surrogates are mixed with each calibration solution to define a range similar to the target compounds.

9.7.3 Surrogate compounds are also contained in continuing calibration checks, and second source calibration check standard.

9.7.4 Spike each sample, QC sample and blank with an appropriate amount of corresponding surrogate spiking solution, prior to extraction, for a final concentration in the extract of 40 µg/l of each surrogate compound.

9.8 Breakdown Evaluation Solution

9.8.1 The DDT and Endrin breakdown evaluation solution is prepared in hexane as outlined in Table 7.

9.9 Storage of Standards

9.9.1 Store unopened stock standard solutions according to the manufacturer's documented holding time and storage temperature recommendations. Protect from light.

9.9.2 Store all other working standard solutions in glass vials with Teflon lined screw caps at ≤ 6°C in the dark.

9.9.3 Opened stock standard solutions must be replaced after 6 months or sooner if manufacturer's expiration date comes first or comparison with quality control check samples indicates a problem.

9.9.4 All other standards must be replaced after six months or sooner if routine QC indicates a problem or manufacturer's expiration date comes first.

10.0 CALIBRATION

10.1 Initial Calibration

10.1.1 The calibration range covered for all single-component analytes employs at least five of the following standards: 2, 5, 10, 25, 50, and 100* µg/l (*this point may be dropped if it exceeds the linear range of the instrument). The method reporting limit is established by the concentration of the lowest standard analyzed during the initial calibration. Lower concentration standard may be needed to meet the reporting limit requirements of state specific regulatory program. The linear range covered by this calibration is the highest concentration standard. Calibration is performed for both the primary and secondary columns.

10.1.2 A calibration range must be constructed for each surrogate compound. Accordingly, add appropriate amounts of each surrogate compound to the calibration solution to define a range similar to the target compounds.

10.1.3 Unless otherwise necessary for a specific project, the analysis of the multi-component analytes (such as: Toxaphene or Chlordane) employs a single-point calibration. This

single calibration standard is included with the initial calibration of the single component analytes for pattern and retention time recognition. For Ohio VAP and Dept. of Defense (DoD) projects an initial 5 point calibration is required for these analytes if there are positive hits.

10.1.4 Aliquot proper amount of each calibration standard into a 2-ml crimp top vial.

10.1.5 Each analyte is quantitatively determined using the external standard technique. The Calibration Factor (CF) is defined in Section 14.1.

10.1.6 For the initial calibration to be valid, the percent relative standard deviation (% RSD) (see Section 14.2) must be less than 20 % for each analyte of interest on each column. If any analyte exceeds the 20% RSD acceptance limit for a given calibration other calibration options, such as linear calibration not through the origin may be used or corrective action must be taken.

10.1.6.1 If the problem is associated with a standard, reanalyze the standard and recalculate the RSD.

10.1.6.2 Alternatively, narrow the calibration range by replacing the low or the high calibration standard that cover a narrow range.

10.1.6.2.1 The changes to the upper end of the calibration range will affect the need to dilute samples above the range, while changes to the lower end will affect the overall sensitivity of the method. Consider the regulatory limits or action levels associated with the target analytes when adjusting the lower end of the range.

10.2 Initial Calibration Verification (ICV) - Second Source Calibration Check Standard

10.2.1 The initial calibration is verified with a second source calibration check standard from an external source (Section 9.6). At a minimum, it must be performed right after the initial calibration.

10.2.2 The percent difference (%D) (Section 14.3) for this standard must meet the %D criteria of 20% used for calibration verification on each column.

10.2.2.1 If %D is greater than 20%, reanalyze the ICV second source check or re-prepare using a fresh ampoule and reanalyze the ICV second source check standard.

10.2.2.2 If the %D criteria cannot be achieved after re-injection of the second source check standard, a new calibration curve must be prepared by making fresh calibration standards using one of the two standard sources that match each other.

10.3 Continuing Calibration Verification (CCV)

10.3.1 Continuing calibration check standards (Section 9.5.2) must be acquired at the beginning of each 12 hour shift prior to analyzing samples, after every 10 injections not to exceed 12 hours and at the end of the analysis sequence. Analysts should alternate

the use of the two different concentration mixtures for calibration verification depending on the range of the curve.

10.3.2 For the continuing calibration to be valid, the percent difference (%D) must be less than 20 % for each compound of interest on each column.

10.3.3 Each sample analysis must be bracketed by periodic analyses of acceptable calibration verification standards followed by an instrument blank, run after 10 injections or 12-hours, whichever is more frequent. If %D criteria fails during a mid sequence calibration check or at the end of the analysis sequence, a continuing calibration check is allowed to be repeated only once; if the second trial fails, a new initial calibration must be performed. In situations where the first check fails to meet the criteria, the instrument logbook should have clear documented notations as to what the problem was and what corrective action was implemented to enable the second check to pass.

10.3.4 When a calibration verification standard fails to meet the QC criteria all samples injected after the last standard that met the QC criteria must be evaluated to prevent misquantitations and possible false negative results. Re-injection of the sample extracts may be required.

10.3.4.1 If the analyte was not detected in the specific samples analyzed during the analytical shift or sequence, the extracts for those samples do not need to be reanalyzed when the calibration standard response is above the initial calibration response, i.e. >20%.

10.3.4.2 If the analyte was detected in the specific samples analyzed during the analytical shift, or the calibration standard response is below the initial calibration response, then the extracts for those samples need to be reanalyzed.

10.3.5 Each subsequent injection of a continuing calibration standard must be checked against the retention time windows established in Section 11.0. If any of these subsequent standards fall outside their absolute retention time windows, the GC system is not in control. Determine the cause of the problem and correct it. If the problem cannot be corrected, a new initial calibration must be performed.

11.0 RETENTION TIME WINDOWS

11.1 Retention time windows must be calculated for each analyte and surrogate on each GC column and whenever a new chromatographic column is installed, when a new initial calibration is analyzed or when there are significant changes in the operating conditions. The retention time windows must be reported with the analysis results in support of the identifications made.

11.2 Employ the following approach to establish retention time windows.

11.2.1 Make three injections of all single component standard mixture and multi-response products at approximately equal intervals during the 72-hr period.

11.2.2 Calculate the mean and standard deviation of the three absolute retention times-recording the retention time to three decimal places (e.g. 10.015 min) - for each single component pesticide.

11.2.3 For multi-response pesticides, choose five major peaks and calculate the mean and standard deviation of the three retention times for those peaks. The peak chosen should be fairly immune to losses due to degradation and weathering in the samples.

11.2.4 In those cases where the standard deviations of the retention time window for a particular pesticide is <0.01 minutes, the laboratory may either collect data from additional injections of standards or use a default standard deviation of 0.01 minutes.

11.2.5 The width of the retention time window for each analyte and surrogate is defined as ± 3 times the standard deviation of the mean absolute retention time established during the 72-hour period. If the default standard deviation is employed, the width of the window will be 0.03 minutes.

11.2.6 Establish the center of the retention time window for each analyte and surrogate by using the absolute retention time for each analyte and surrogate from the calibration verification standard at the beginning of the analytical shift. For samples run during the same shift as an initial calibration, use the retention time of the mid-point standard of the initial calibration.

12.0 PROCEDURE

12.1 Sample Extraction

12.1.1 In general, water samples are extracted at a neutral pH with methylene chloride using a separate funnel (Method 3510) (Refer to SOP: EOP001). Solid samples are extracted using Method 3545A, Pressurized Fluid Extraction (Refer to SOP: EOP040A) or Method 3550C, Sonication (Refer to SOP: EOP003).

12.2 Sample Cleanup

12.2.1 Cleanup procedures may not be necessary for a relatively clean sample matrix, but most extracts from environmental and waste samples will require additional preparation before analysis. The specific cleanup procedure used will depend on the nature of the sample to be analyzed and the data quality objectives for the measurements. Refer to the appropriate SOPs for details.

12.2.1.1 If a sample is of biological origin, or contains high molecular weight materials, the use of Method 3640 (GPC cleanup - pesticide option) is recommended. Frequently, one of the adsorption chromatographic cleanups (alumina, silica gel, or florisil) may also be required following the GPC cleanup.

12.2.1.2 Method 3610 (alumina) may be used to remove phthalate esters.

12.2.1.3 Method 3620 (florisil) may be used to separate organochlorine pesticides from aliphatic compounds, aromatics, and nitrogen-containing compounds.

12.2.1.4 Method 3630 (silica gel) may be used to separate single component organochlorine pesticides from some interferants.

12.2.1.5 Elemental sulfur, which may be present in certain sediments and industrial wastes, interferes with the electron capture gas chromatography of certain pesticides. Sulfur should be removed by the technique described in Method 3660.

12.3 Instrument Conditions

12.3.1 Recommended instrument conditions are listed in Table 2. Modifications of parameters specified with an asterisk are allowed as long as criteria of calibration are met. Any modification should be approved by team leader/manager.

12.4 DDT and Endrin Breakdown Evaluation

12.4.1 DDT and Endrin are easily degraded in the injection port. Breakdown occurs when the injection port liner is contaminated high boiling residue from sample injection or when the injector contains metal fittings. Check for degradation problems by injecting a standard containing only 4,4'-DDT and Endrin. Presence of 4,4'-DDE, 4,4'-DDD, Endrin ketone or Endrin aldehyde indicates breakdown.

12.4.2 Before the initial calibration and at the beginning of each 12-hour shift, inject 1 µl of an evaluation standard directly on column. (Refer to Section 9.8).

12.4.3 Calculate the percent breakdown for Endrin and DDT (Section 14.7) and save the breakdown report in the LIMS system.

12.4.4 If degradation of either DDT or Endrin exceeds 15%, injector maintenance should be completed before proceeding with calibration. Refer to EQA036-01 for GC system maintenance utilized in the lab.

12.5 Initial Calibration

12.5.1 See Section 10.1.

12.6 Initial Calibration Verification (ICV)

12.6.1 Refer to Section 10.2.

12.7 Continuing Calibration Verification (CCV)

12.7.1 Refer to Section 10.3.

12.8 Sample Analysis (Primary)

12.8.1 All samples and quality control samples are injected into the Gas Chromatograph using the autosampler. Program the sampler for an appropriate number of syringe rinses and a 1ul or 2 µl injection size. A splitless injection technology is used.

12.8.2 Sample concentrations are calculated by comparing sample responses with the initial calibration of the system (Section 14.4). If sample response exceeds the limits of the initial calibration range, dilute the extract and reanalyze. Extracts should be diluted so that all peaks are on scale, as overlapping peaks are not always evident when peaks are off scale.

12.8.3 Sample injections may continue for as long as the calibration verification standards meet instrument QC requirements. The sequence ends when the set of samples has been injected or when qualitative and/or quantitative QC criteria are exceeded.

12.8.4 If chromatographic peaks are masked by the presence of interferences, further sample cleanup is necessary. Refer to Section 12.2 for extract cleanup alternatives.

12.8.4.1 If extract cleanup is required, all QC samples must also be processed through the cleanup method.

12.9 Confirmation Analysis

12.9.1 Confirmation analysis is to confirm the presence of all compounds tentatively identified in the primary analysis.

12.9.1.1 All instrument performance quality control criteria for calibration and retention times must be satisfied on the confirmation analysis.

12.9.2 Each tentative identification must be confirmed using either a second GC column of dissimilar stationary phase or using another technique such as GC/MS.

12.9.2.1 The primary and secondary analysis is conducted simultaneously in the dual-column analysis.

12.9.2.2 GC/MS confirmation may be used in conjunction with dual-column analysis if the concentration is sufficient for detection in GC/MS, normally a concentration of approximately 10 ng/µl in the final extract for each single component compound is required. Method 8270 is recommended as a confirmation technique when sensitivity permits.

12.9.3 Once the identification has been confirmed, the agreement between the quantitative results on both columns should be checked.

12.10 Sample Dilution

12.10.1 Establish dilution of sample in order to fall within calibration range or to minimize the matrix interference.

* Utilize screen data (specific project only).
* Utilize acquired sample data.
* Utilize the history program or approval from client/project.
* Sample characteristics (appearance).

12.10.2 If no lower dilution has been reported, the dilution factor chosen should keep the response of the largest peak for a target analyte in the upper half of the initial calibration range of the instrument.

12.10.3 Preparing Dilutions.

12.10.3.1 Prepare sample dilutions quantitatively. Dilute a stored sample extract, if available with hexane using logical volume to volume ratios, i.e., 1:5, 1:10, 1:50, etc.

12.10.3.2 Syringe dilutions. – Refer to Table 8 for dilutions. A calibrated 1ml syringe must be used to prepare dilutions. Gently shake to disperse the extract throughout the solvent prior to loading on the auto-sampler tray for further analysis.

12.10.3.3 Volumetric Flask Dilutions - Dilutions can also be made with a Class A volumetric flask. Measure the appropriate sample extract volume in a calibrated syringe and bring to final volume with dilution solvent in a Class A volumetric flask. Gently shake to disperse the extract throughout the solvent and transfer to auto-sampler vial for analysis.

12.11 Data interpretation

12.11.1 Qualitative identification

12.11.1.1 Analyst shall identify the targeted compounds with competent knowledge interpreting retention time and/or chromatographic pattern by comparison of the sample to the standard of the suspected compound. The criteria required for a positive identification are:

12.11.1.1.1 The sample component must elute at the absolute retention time window (Refer to Section 11.0) for both primary and confirmation run.

12.11.1.1.2 For the multi-response pesticides, at least five major peaks are selected. The retention time window for each peak is determined from the initial calibration analysis. Identification of a multi-component analyte in the sample is based on pattern recognition in conjunction with the elution of these five peaks within the retention time windows of the corresponding peaks of the standard on both GC columns.

12.11.1.1.3 Be aware of matrix interfering effects on peak shape and relative peak ratios that could distort the pattern. Interpretation of these phenomena may require a highly experienced chromatographer or at least a second opinion.

12.11.2 Quantitative analysis

12.11.2.1 When a target compound has been identified, concentration (see section 14.4) will be based on the integrated area/or height of the peak and calculated by

external standard technique. Proper quantitation requires the appropriate selection of a baseline from which the peak area or height can be determined.

12.11.2.2 For multi-response pesticides, usually the areas of 5 peaks are used for quantitation to calculate the calibration factors for those peaks, but fewer may be used depending on the extent of matrix interferences. These calibration factors are then used to calculate the concentration of each corresponding peak in the sample chromatogram and the resulting concentrations are averaged to provide the final result for the sample.

12.11.2.3 When sample results are confirmed using two dissimilar columns or with two dissimilar detectors, the agreement between the quantitative results must be evaluated after the identification has been confirmed. Calculate the relative percent difference (RPD) between the two results using the formula in Section 14.6. Report the lower result.

12.11.2.3.1 A program to perform the RPD calculation had been developed and incorporated into ENVIROQUANT software.

12.11.2.3.2 If one result is significantly higher (e.g., >40%), check the chromatograms to see if an obviously overlapping peak is causing an erroneously high result. If no overlapping peaks are noted, examine the baseline parameters established by the instrument data system (or operator) during peak integration.

12.11.2.3.3 If no anomalies are noted, review the chromatographic conditions. If there is no evidence of chromatographic problems, report the lower result with the footnote (remark) indicating "More than 40% RPD for detected concentrations between two GC columns".

13.0 QUALITY CONTROL

13.1 QC Requirements Summary

DDT and Endrin Breakdown Evaluation	Every 12-hour shift
ICV -Second Source Calibration	Following initial calibration
Continuing Calibration Checks	Every 12-hour shift or 10 injections (whichever is more frequent) and at the end of analysis sequence
Method Blank	One per extraction batch* or per day for a running batch
Blank Spike	One per extraction batch* or per day for a running batch
Matrix Spike	One per extraction batch*
Matrix Spike Duplicate	One per extraction batch*
Surrogate	Every sample and standard

*The maximum number of samples per batch is twenty or per project specification.

13.2 DDT and Endrin Breakdown Evaluation

13.2.1 Refer to Section 12.4.

13.3 Initial Calibration Verification (ICV) - Second Source Calibration Check

13.3.1 Refer to Section 10.2.

13.4 Continuing Calibration Verification (CCV)

13.4.1 Refer to Section 10.3.

13.5 Method Blank

13.5.1 The method blank is either DI water or sodium sulfate (depending upon the sample matrix) which must be extracted with each set of 20 or less samples. For a running batch, a new method blank is required for each different extraction day. The method blank are then extracted and run through any clean-up procedures along with the other samples in that batch.

13.5.2 If the method blank contains a target analyte above its MDL, the entire batch must be re-extracted and re-analyzed.

13.5.3 Surrogate compounds are added to the method blank prior to extraction and analysis. If the surrogate accuracy in the blank does not meet criteria, the entire batch must be re-extracted and re-analyzed.

13.6 Blank Spike

13.6.1 A blank spike must be extracted with each set of 20 or less samples. For a running batch, a new blank spike is required for each different extraction day. The blank spike consists of an aliquot of a clean (control) matrix similar to the sample matrix and of the same weight or volume. A separate blank spike may be needed if the sample requires Chlordane and/or Toxaphene. It is spiked with the same analytes at the same concentrations as the matrix spike/matrix spike duplicate.

13.6.1.1 For single-component analytes, the blank spike is prepared at 0.25 µg/l or 8.33 µg/kg on a dry weight basis.

13.6.1.2 For Toxaphene only analysis or per project specification, the blank spike is prepared at 5 µg/l or 167 µg/kg on a dry weight basis.

13.6.1.3 For Chlordane only analysis or per project specification, the blank spike is prepared at 4 µg/l or 133 µg/kg on a dry weight basis.

13.6.2 The blank spike recoveries should be assessed using in house limits..

13.6.3 If a blank spike is out of control, the following corrective actions must be taken. In the case where the blank spike recovery is high and no hits reported in associated samples and QC batch the sample results can be reported with footnote (remark) and no further action is required.

13.6.3.1 Check to be sure that there are no errors in the calculations, or spike solutions. If errors are found, recalculate the data accordingly.

13.6.3.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample batch.

13.6.3.3 If no problem is found, re-extract and reanalyze the sample batch.

13.7 Matrix Spike (MS)/Matrix Spike Duplicate (MSD)

13.7.1 One sample is randomly selected from each extraction batch of similar matrix types and spiked in duplicate to determine whether the sample matrix contributes bias to the analytical results.

13.7.2 A separate matrix spike and matrix spike duplicate set may be needed if the sample requires Chlordane and/or Toxaphene. Matrix spikes are prepared by spiking an actual sample for a concentration of 0.25 µg/l or 8.33 µg/kg on a dry weight basis for pesticides, 5 µg/l or 167 µg/kg for Toxaphene, 4 µg/l or 133 µg/kg for Chlordane.

13.7.3 Assess the matrix spike recoveries and relative percent difference (RPD) against the in house control limits.

13.7.4 If the matrix spike accuracy of any individual compound is out of control, the accuracy for the compound in the blank spike must be within control. Matrix interference is assumed and the data is reportable. No further corrective action is required.

13.8 Surrogates

13.8.1 Tetrachloro-m-xylene (TCMX) and Decachlorobiphenyl (DCB) are used as surrogate standards. All blanks, samples, QC samples, and calibration standards contain surrogate compounds which are used to monitor performance of the extraction, cleanup (when used), and analytical system.

13.8.2 The recoveries (refer to Section 14.5) of the surrogates must be evaluated versus the surrogate control limits developed by the laboratory.

13.8.3 If surrogate recovery is not within established control limits, corrective action must be performed if surrogate recoveries indicate that a procedural error may have occurred during the analysis of the sample.

13.8.3.1 Check the surrogate calculations for calculation or integration errors and perform corrections if detected.

13.8.3.2 Re-analyze the extract if calculation errors are not detected. If the surrogate recoveries for the re-analyzed extract are in control, report data from the re-analysis only.

13.8.3.3 If data from the reanalysis is also out of control, re-extract and reanalyze the sample.

13.8.3.4 If, upon reanalysis, the surrogate recoveries are acceptable, report the reanalysis data. If the holding time has expired prior to the reanalysis, report both the original and reanalysis results and note the holding time problem.

13.8.3.5 If the recovery is again not within limits, the problem is considered to be matrix interference. Submit both data sets with the original analysis being reported.

13.8.4 The retention time shift for surrogate must be evaluated after the analysis of each sample. The sample should be reanalyzed when the retention time of any surrogate compound is outside the retention window.

13.8.4.1 Reanalysis may not be required for samples having visible matrix interference, defined as excessive signal levels from target or non-target interfering peaks. This judgment should be approved by team leader or supervisor.

13.9 Refer to Project Specific Bench Notes (GC8081) for additional program or client specific QC requirements.

14.0 CALCULATION

14.1 Calibration Factor (CF).

$$CF = \frac{A_s}{C_s}$$

where:
A_s = Area of the peak for the compound being measured.
C_s = Concentration of the compound being measured (µg/l).

14.2 Percent Relative Standard Deviation (% RSD).

$$\%RSD = \frac{SD}{CF_{av}} \times 100$$

where:
SD = Standard Deviation.
CF_{av} = Average calibration factor from initial calibration.

14.3 Percent Difference (% D).

$$\% D = \frac{| CF_{av} - CF_c |}{CF_{av}} \times 100$$

where:
CF_c = CF from continuing calibration (CBCHK).

14.4 Concentration (Conc.).

14.4.1 For water:

$$\text{Conc. } (\mu g/l) = \frac{A_c \times M}{CF_{av}}$$

$$M = \frac{V_f \times D}{V_i}$$

14.4.2 For soil/sediment (on a dry weight basis, see EGN007):

$$\text{Conc. } (\mu g/kg) = \frac{A_c \times M}{CF_{av}}$$

$$M = \frac{V_f \times D}{W_s \times S}$$

where:
A_c = Area of peak for compound being measured.
V_f = Final Volume of total extract (ml).
D = Secondary dilution factor.
V_i = Initial volume of water extracted (ml).
W_s = Weight of sample extracted (g).
S = (100 - % moisture in sample) / 100 or % solid/100.
M = Multiplier.

14.5 Percent Recovery (% R).

$$\%\ R = \frac{\text{Concentration found}}{\text{Concentration spiked}} \times 100$$

14.6 Relative Percent Difference (RPD).

$$RPD = \frac{|C_1 - C_2|}{(1/2)(C_1 + C_2)} \times 100$$

where:
C_1 = Matrix Spike Concentration or the result on column 1.
C_2 = Matrix Spike Duplicate Concentration or the result on column 2.

14.7 Percent Breakdown.

$$\%\ \text{Breakdown for DDT} = \frac{\text{Total DDT degradation peak area}}{\text{Total DDT peak area}} \times 100$$

where:
Total DDT degradation peak area = DDE + DDD
Total DDT peak area = DDT + DDE + DDD

$$\% \text{ Breakdown for Endrin} = \frac{\text{Total Endrin degradation peak area}}{\text{Total Endrin peak area}} \times 100$$

where:
Total Endrin degradation peak area = Endrin aldehyde + Endrin ketone.
Total Endrin peak area = Endrin + Endrin aldehyde + Endrin ketone.

15.0 DOCUMENTATION

15.1 The Analytical Logbook is a record of the analysis sequence; the logbook must be completed daily. Each instrument will have a separate logbook.

15.1.1 If samples require reanalysis, a brief explanation of the reason must be documented in this log. For consistency, if surrogates are high or low indicate it as (↑) for high and (↓) for low.

15.2 The Standard Preparation Logbook must be completed for all standard preparations. All information requested must be completed, the page must be signed and dated by the respective person.

15.2.1 The Accutest Lot Number must be cross-referenced on the standard vial.

15.3 The Instrument Maintenance Logbook must be completed when any type of maintenance is performed on the instrument. Each instrument has a separate log.

15.4 Any corrections to laboratory data must be done using a single line through the error. The initials of the person and date of correction must appear next to the correction.

15.5 Unused blocks of any form must be x'ed or z'ed by the analyst before submitting the data for review.

15.6 Supervisory (or peer) personnel must routinely review (at least once per month) all laboratory logbooks to ensure that information is being recorded properly. Additionally, the maintenance of the logbooks and the accuracy of the recorded information should also be verified during this review.

16.0 DATA REVIEW AND REPORTING

16.1 Initial and continuing calibration check. Verify that all calibration and continuing calibration criteria have been achieved. If the criteria had not been achieved, corrective action must be performed to bring the system in control before analyzing any samples.

16.1.1 If samples had been analyzed under non-compliant calibration criteria, all sample extracts must be re-analyzed once the system is brought into control.

16.2 Quality Control Data Review. Review all QC data. If QC criteria were not achieved, perform corrective action before proceeding with analysis.

16.2.1 In some situation, corrective action may demand that the entire sample batch be re-extracted and re-analyzed before processing data.

16.3 Chromatogram Review. The chromatogram of each sample is evaluated for target compounds.

16.3.1 Check specific retention time windows for each target compound for the presence of the target compound in each chromatogram.

16.3.1.1 Each sample may require the reporting of different target compounds. Review the login to assure that the correct target compounds are identified.

16.3.2 The compound must be identified on the primary and confirmatory column before assigning a qualitative identification.

16.3.3 Manual integration of chromatographic peaks must be identified by the analysts by initialing and dating the changes made to the report.

16.4 Transfer to LIMS. Following the initial screen review, transfer the processed data to the LIMS.

17.0 POLLUTION PREVENTION & WASTE MANAGEMENT

17.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 17.2.

17.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, EHS004. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:

17.2.1 Non hazardous aqueous wastes.

17.2.2 Hazardous aqueous wastes

17.2.3 Chlorinated organic solvents

17.2.4 Non-chlorinated organic solvents

17.2.5 Hazardous solid wastes

17.2.6 Non-hazardous solid wastes

Table 1. Target Compound List and Reporting Limits			
Compound	**CAS No.**	**Water (µg/l)**	**Soil (µg/kg)**
alpha-BHC	319-84-6	0.02	0.67
beta-BHC	319-85-7	0.02	0.67
delta-BHC	319-86-8	0.02	0.67
Gamma-BHC (Lindane)	58-89-9	0.02	0.67
Heptachlor	76-44-8	0.02	0.67
Aldrin	309-00-2	0.02	0.67
Heptachlor epoxide	1024-57-3	0.02	0.67
Endosu1fan I	959-98-8	0.02	0.67
Dieldrin	60-57-1	0.02	0.67
4,4'-DDE	72-55-9	0.02	0.67
Endrin	72-20-8	0.02	0.67
Endosulfan II	33213-65-9	0.02	0.67
4,4'-DDD	72-54-8	0.02	0.67
Endosulfan sulfate	1031-07-8	0.02	0.67
4,4'-DDT	50-29-3	0.02	0.67
Methoxychlor	72-43-5	0.05	1.70
Endrin ketone	53494-70-5	0.05	1.70
Endrin aldehyde	7421-93-4	0.02	0.67
α-Chlordane	5103-71-9	0.02	0.67
γ-Chlordane	5103-74-2	0.02	0.67
Mirex	2385-85-5	0.02	0.67
Chlordane (technical)	12789-03-6	0.50	17.0
Toxaphene	8001-35-2	0.25	8.50

Table 2. RECOMMENDED OPERATING CONDITION	
Gas Chromatograph/Electron Capture Detectors	
Carrier Gas	Helium
Make-up gas	5 % Methane/ 95 % Argon
Make-up gas flow	*40 ml/min
Injection port temperature	*280°C
Injection type	Splitless
Detector temperature	*320°C
Column flow	2 ml/min
Gas Chromatograph Temperature Program*	
Initial temperature	*160°C
Time 1	*2 minutes
Column temperature rate 1	*45 degrees/min
Temperature 1	*200°C
Column temperature rate 2	*7 degrees/min
Temperature 2	*260°C
Column temperature rate 3	*50 degrees/min
Final temperature	*305°C
Time 3	*0.8 minutes
Total run time	10-20 minutes

*Parameter modification allowed for performance optimization as long as QC criteria are achieved.

Table 3. Pesticides and Surrogates Working Solution	
Stock Solution	**Volume Added**
Pesticides Mixture (1,000 µg/ml)	0.1 ml
Pesticides Surrogate Std Spiking Solution (200 µg/ml)	0.5ml
Mirex (1000ug/ml) (optional)	0.1ml
Hexane	9.4 ml (or 9.3 ml with Mirex)
Total	10.0 ml

Pesticides Mixture (10 µg/ml) and Surrogates (10 µg/ml) Working Solution: Prepared by measuring 0.1 ml of 1,000 µg/ml of pesticides mixture, 0.5ml of 200 µg/ml pesticides surrogate std spiking solution and bringing to 10 ml with hexane. Note larger or smaller volumes of standards may be prepared, as needed using the same ratios. ICV is prepared in the same way, but a second source is used.

Table 4A. Pesticides Calibration Standard Solutions					
Solution	**Working Solution**	**Concentration (µg/ml)**	**Volume Added (µl)**	**Final Volume in Hexane (ml)**	**Final Concentration(µg/l)**
Standard A	Pesticides Mixture	10	500	50	100
	Surrogates	10			100
Standard B	Pesticides Mixture	10	250	50	50
	Surrogates	10			50
Standard C	Pesticides Mixture	10	125	50	25
	Surrogates	10			25
Standard D	Pesticides Mixture	10	50	50	10
	Surrogates	10			10
Standard E	Pesticides Mixture	10	25	50	5
	Surrogates	10			5
Standard F	Pesticides Mixture	10	10	50	2
	Surrogates	10			2

Standard A: Prepared by measuring 500 µl of Pesticides Mixture (10 µg/ml) and Surrogates (10 µg/ml) Working Solution and bringing to 50 ml with hexane.

Standard B: Prepared by measuring 250 µl of Pesticides Mixture (10 µg/ml) and Surrogates (10 µg/ml) Working Solution and bringing to 50 ml with hexane.

Standard C: Prepared by measuring 125 µl of Pesticides Mixture (10 µg/ml) and Surrogates (10 µg/ml) Working Solution and bringing to 50 ml with hexane.

Standard D: Prepared by measuring 50 µl of Pesticides Mixture (10 µg/ml) and Surrogates (10 µg/ml) Working Solution and bringing to 50 ml with hexane.

Standard E: Prepared by measuring 25 µl of Pesticides Mixture (10 µg/ml) and Surrogates (10 µg/ml) Working Solution and bringing to 50 ml with hexane.

Standard F: Prepared by measuring 10 µl of Pesticides Mixture (10 µg/ml) and Surrogates (10 µg/ml) Working Solution and bringing to 50 ml with hexane.

Table 4B. Toxaphene Calibration Standard Solution (20ug/ml)	
Stock Solution	**Volume Added (µl)**
Toxaphene stock (4000 µg/ml)	125
Pesticides Surrogate Std Spiking Solution (200 µg/ml)	100
Hexane	24775
Total	25000

Toxaphene (20 µg/ml) and Surrogates (0.80 µg/l) Calibration Solution: Prepared by measuring 125 µl of 4000 µg/ml of Toxaphene stock solution, 100 µl of 200 µg/ml pesticides surrogate std spiking solution and bringing to 25 ml with hexane.

Table 4C. Chlordane Calibration Standard Solution (20 µg/ml)	
Stock Solution	**Volume Added (µl)**
Chlordane stock (2000 µg/ml)	250
Pesticides Surrogate Std Spiking Solution (200 µg/ml)	100
Hexane	24650
Total	25000

Chlordane (20 µg/ml) and Surrogates (0.80 µg/ml) Calibration Solution: Prepared by measuring 250 µl of 2000 µg/ml of Chlordane stock solution, 100 µl of 200 µg/ml pesticides surrogate std spiking solution and bringing to 25 ml with hexane.

Table 4D. Multi-point Toxaphene Calibration Standards (optional)					
Solution	**Stock Solution**	**Concentration (µg/ml)**	**Volume Added (µl)**	**Final Volume in Hexane (ml)**	**Final Concentration(µg/l)**
Standard A	Toxaphene	20	3750	25	3000
	Surrogate Spiking	0.8	3750		120
Standard B	Toxaphene	20	2500	25	2000
	Surrogate Spiking	0.8	2500		80
Standard C	Toxaphene	20	1250	25	1000
	Surrogate Spiking	0.8	1250		40
Standard D	Toxaphene	20	625	25	500
	Surrogate Spiking	0.8	625		20
Standard E	Toxaphene	20	312.5	25	250
	Surrogate Spiking	0.8	312.5		10
Standard F	Toxaphene	20	62.5	25	50
	Surrogate Spiking	0.8	62.5		2

Standard A: Prepared by measuring 3750 µl of 20 µg/ml of Toxaphene stock solution, 3750 µl of 0.8 µg/ml pesticides surrogate std spiking solution and bringing to 25 ml with hexane.

Standard B: Prepared by measuring 2500 µl of 20 µg/ml of Toxaphene stock solution, 2500 µl of 0.8 µg/ml pesticides surrogate std spiking solution and bringing to 25 ml with hexane.

Standard C: Prepared by measuring 1000 µl of 20 µg/ml of Toxaphene stock solution, 1000 µl of 0.8 µg/ml pesticides surrogate std spiking solution and bringing to 25 ml with hexane.

Standard D: Prepared by measuring 625 µl of 20 µg/ml of Toxaphene stock solution, 625 µl of 0.8 µg/ml pesticides surrogate std spiking solution and bringing to 25 ml with hexane.

Standard E: Prepared by measuring 312.5 µl of 20 µg/ml of Toxaphene stock solution, 312.5 µl of 0.8 µg/ml pesticides surrogate std spiking solution and bringing to 25 ml with hexane.

Standard F: Prepared by measuring 62.5 µl of 20 µg/ml of Toxaphene stock solution, 32.5 µl of 0.8 µg/ml pesticides surrogate std spiking solution and bringing to 25 ml with hexane.

Table 4E. Multi-point Chlordane Calibration Standards (optional)					
Solution	**Stock Solution**	**Concentration (µg/ml)**	**Volume Added (µl)**	**Final Volume in Hexane (ml)**	**Final Concentration(µg/l)**
Standard A	Chlordane	20	3750	25	3000
	Surrogate Spiking	0.8	3750		120
Standard B	Chlordane	20	2500	25	2000
	Surrogate Spiking	0.8	2500		80
Standard C	Chlordane	20	1250	25	1000
	Surrogate Spiking	0.8	1250		40
Standard D	Chlordane	20	625	25	500
	Surrogate Spiking	0.8	625		20
Standard E	Chlordane	20	312.5	25	250
	Surrogate Spiking	0.8	312.5		10
Standard F	Chlordane	20	62.5	25	50
	Surrogate Spiking	0.8	62.5		2

Standard A: Prepared by measuring 3750 µl of 20 µg/ml of Chlordane stock solution, 3750 µl of 0.8 µg/ml pesticides surrogate std spiking solution and bringing to 25 ml with hexane.

Standard B: Prepared by measuring 2500 µl of 20 µg/ml of Chlordane stock solution, 2500 µl of 0.8 µg/ml pesticides surrogate std spiking solution and bringing to 25 ml with hexane.

Standard C: Prepared by measuring 1000 µl of 20 µg/ml of Chlordane stock solution, 1000 µl of 0.8 µg/ml pesticides surrogate std spiking solution and bringing to 25 ml with hexane.

Standard D: Prepared by measuring 625 µl of 20 µg/ml of Chlordane stock solution, 625 µl of 0.8 µg/ml pesticides surrogate std spiking solution and bringing to 25 ml with hexane.

Standard E: Prepared by measuring 312.5 µl of 20 µg/ml of Chlordane stock solution, 312.5 µl of 0.8 µg/ml pesticides surrogate std spiking solution and bringing to 25 ml with hexane.

Standard F: Prepared by measuring 62.5 µl of 20 µg/ml of Chlordane stock solution, 32.5 µl of 0.8 µg/ml pesticides surrogate std spiking solution and bringing to 25 ml with hexane.

Table 5. Continuing Calibration Check Solutions					
Checks	**Working Solution**	**Concentration (µg/ml)**	**Volume Added (µl)**	**Final Volume in Hexane (ml)**	**Final Concentration(µg/l)**
Solution 1	Pesticides Mixture	10	250	50	50
	Surrogates	10			50
Solution 2	Pesticides Mixture	10	50	50	10
	Surrogates	10			10
Solution 3	Pesticides Mixture	10	125	50	25
	Surrogates	10			25

Solution 1: Prepared by measuring 250 µl of Pesticides Mixture (10 µg/ml) and Surrogates (10 µg/ml) Working Solution and bringing to 50 ml with hexane.

Solution 2: Prepared by measuring 50 µl of Pesticides Mixture (10 µg/ml) and Surrogates (10 µg/ml) Working Solution and bringing to 50 ml with hexane.

Solution 3: Prepared by measuring 125 µl of Pesticides Mixture (10 µg/ml) and Surrogates (10 µg/ml) Working Solution and bringing to 50 ml with hexane.

Table 6. DDT and Endrin Breakdown Evaluation Standard	
Stock Solution	**Volume Added (µl)**
Pesticides Performance Evaluation Mixture (10-250 µg/ml)	50
Hexane	49950
Total	50000

DDT and Endrin Breakdown Evaluation Standard (10-250 µg/l): Prepared by measuring 50 µl of Pesticides Performance Evaluation Mixture (10-250 µg/ml) and diluting to 50 ml with hexane.

Table 7
Sample Dilution Table

All dilutions must be made using a 1ml calibrated syringe.

Dilution	*Intact Sample*	*Solvent*
1:2	500ul	500ul
1:5	200ul	800ul
1:10	100ul	900ul
1:20	50ul	950ul
1:25	40ul	960ul
1:50	20ul	980ul

Two Step dilution

Dilution	Step 1		Step 2	
	Intact Sample	*Solvent*	*Sample Aliquot from Step 1*	*Solvent*
1:100	100ul	900ul	100ul	900ul
1:200	100ul	900ul	50ul	950ul
1:250	100ul	900ul	40ul	960ul
1:500	100ul	900ul	20ul	980ul

Three Step Dilution

Dilution	Step 1		Step 2		Step 3	
	Intact Sample	*Solvent*	*Sample Aliquot from Step 1*	*Solvent*	*Sample Aliquot from Step 2*	*Solvent*
1:1000	100ul	900ul	100ul	900ul	100ul	900ul
1:2000	100ul	900ul	100ul	900ul	50ul	950ul
1:2500	100ul	900ul	100ul	900ul	40ul	960ul
1:5000	100ul	900ul	100ul	900ul	20ul	980ul

Four Step Dilution

Dilution	Step 1		Step 2		Step 3		Step 4	
	Intact Sample	*Solvent*	*Sample Aliquot from Step 1*	*Solvent*	*Sample Aliquot from Step 2*	*Solvent*	*Sample Aliquot from Step 3*	*Solvent*
1:10,000	100ul	900ul	100ul	900ul	100ul	900ul	100ul	900ul
1:20,000	100ul	900ul	100ul	900ul	100ul	900ul	50ul	950ul
1:25,000	100ul	900ul	100ul	900ul	100ul	900ul	40ul	960ul
1:50,000	100ul	900ul	100ul	900ul	100ul	900ul	20ul	980ul

ACCUTEST LABORATORIES
Standard Operating Procedures

Lab Manager

QA Manager

Effective Date: 12/15/2010

TEST NAME **SW846 8082A: DETERMINATION OF POLYCHLORINATED BIPHENYLS (PCBs) BY GAS CHROMATOGRAPHY**

METHOD REFERENCE SW846 8082A (Revision 1, February 2007)

Revised Sections: *3.2, 13.5.2, 13.5.3, Added section 13.9*

1.0 SCOPE AND APPLICATION

1.1 This SOP describes the analytical procedures, which are utilized by Accutest to acquire samples for analysis of polychlorinated biphenyls (PCBs) as Aroclors, using dual open-tubular, capillary columns with electron capture detectors (ECD).

1.2 This gas chromatographic (GC) method applicable to the determination of the PCB Aroclors listed in Table 1 in extracts from solid and aqueous matrices.

2.0 SUMMARY OF METHOD

2.1 A measured volume or weight of sample (approximately 1 L for liquids, 15 g for solids) is extracted using the appropriate matrix-specific sample extraction technique. Petroleum Products and organic wastes are diluted with an organic solvent and follow SW 846 Method 3580A. Aqueous samples are extracted at neutral pH with methylene chloride using Method 3510 (separatory funnel). Solid samples are extracted with using Method 3545A, Pressurized Fluid Extraction.

2.2 Extracts for PCB analysis may be subjected to a sulfuric acid/potassium permanganate cleanup (Method 3665) designed specifically for these analytes. This cleanup technique will remove (destroy) many single component organochlorine or organophosphorus pesticides.

2.3 After cleanup, the extract is analyzed by injecting a 1 or 2-µL aliquot into a gas chromatograph with dual narrow bore fused silica capillary columns and electron capture detectors (GC/ECD). The chromatographic data may be used to determine the seven Aroclors In Table 1.

2.4 The peaks detected are qualitatively identified by comparison to retention times specific to the known target list of PCBs on two different column types (primary and confirmation).

2.5 Once identified, the Aroclor is quantitated by external standard techniques with an average calibration factor generated from a calibration curve.

3.0 REPORTING LIMIT AND METHOD DETECTION LIMIT

3.1 Reporting Limit. The reporting limit for this method is established at the lowest concentration standard in the calibration curve. RL's may vary depending on matrix difficulties and sample volumes or weight and percent moisture. Refer to Table 1 for current reporting limits.

3.2 Method Detection Limit. Experimentally determine MDLs using the procedure specified in 40 CFR, Part 136, Appendix B. This value represents the lowest reportable concentration of an individual compound that meets the method qualitative identification criteria.

3.2.1 Experimental MDLs must be determined annually for this method.

3.2.2 Process all raw data for the replicate analysis in each MDL study. Forward the processed data to the QA group for archiving.

4.0 DEFINITIONS

BLANK - an analytical sample designed to assess specific sources of laboratory contamination. The types of blanks are Method Blank; Instrument Blank, Storage Blank, and Sulfur Blank.

CALIBRATION FACTOR (CF) - a measure of the gas chromatographic response of a target analyte to the mass injected. The calibration factor is analogous to the Relative Response Factor (RRF) used in the Volatile and Semivolatile fractions.

CONTINUING CALIBRATION - analytical standard run every 12 hours and at the end of analytical sequence to verify the initial calibration of the system.

CONTINUOUS LIQUID-LIQUID EXTRACTION - used herein synonymously with the terms continuous extraction, continuous liquid extraction, and liquid extraction. This extraction technique involves boiling the extraction solvent in a flask and condensing the solvent above the aqueous sample. The condensed solvent drips through the sample, extracting the compounds of interest from the aqueous phase.

INITIAL CALIBRATION - analysis of analytical standards for a series of different specified concentrations; used to define the linearity and dynamic range of the response of the electron capture detector to the target compounds.

MATRIX - the predominant material of which the sample to be analyzed is composed. For the purpose of this SOP, a sample matrix is either water or soil/sediment. Matrix is not synonymous with phase (liquid or solid).

MATRIX SPIKE - aliquot of a matrix (water or soil) fortified (spiked) with known quantities of specific compounds and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery.

MATRIX SPIKE DUPLICATE - a second aliquot of the same matrix as the matrix spike (above) that is spiked in order to determine the precision of the method.

METHOD BLANK - an analytical control consisting of all reagents, internal standards and surrogate standards (or SMCs for VOA), that is carried throughout the entire analytical procedure. The method blank is used to define the level of laboratory, background and reagent contamination.

METHOD DETECTION LIMITS (MDLs) - The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. MDLs should be determined approximately once per year for frequently analyzed parameters.

PERCENT DIFFERENCE (%D) - As used in this SOP and elsewhere to compare two values, the percent difference indicates both the direction and the magnitude of the comparison, i.e., the percent difference may be either negative, positive, or zero. (In contrast, see relative percent difference.)

PERCENT MOISTURE - an approximation of the amount of water in a soil/sediment sample made by drying an aliquot of the sample at 105°C. The percent moisture determined in this manner also includes contributions from all compounds that may volatilize at or below 105 °C, including water. Percent moisture may be determined from decanted samples and from samples that are not decanted.

REAGENT WATER - water in which an interferant is not observed at or above the minimum detection limit of the parameters of interest.

RELATIVE PERCENT DIFFERENCE (RPD) - As used in this SOP and elsewhere to compare two values, the relative percent difference is based on the mean of the two values, and is reported as an absolute value, i.e., always expressed as a positive number or zero. (In contrast, see percent difference.)

RELATIVE RESPONSE FACTOR (RRF) - a measure of the instrument response of an analyte. Response Factors are determined by analysis of standards and are used in the calculation of concentrations of analytes in samples.

RETENTION TIME (RT) - the time required (in minutes) for a standard compound to elute from a chromatographic column.

SURROGATES - for semivolatiles and pesticides/Aroclors, compounds added to every blank, sample, matrix spike, matrix spike duplicate, and standard; used to evaluate analytical efficiency by measuring recoveries. Surrogate are brominated, fluorinated, or isotopically labeled compounds not expected to be detected in environmental media.

INSTRUMENT BLANK - a system evaluation sample containing solvent and surrogate standards added. An instrument blank is used to remove and/or evaluate residual carryover from high level standards, spike samples and field samples.

5.0 HEALTH & SAFETY

5.1 The analyst must follow normal safety procedures as outlined in the Accutest Health and Safety Plan and Personal Protection Policy, which includes the use of safety glasses and lab coats. In addition, all acids are corrosive and must be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical must be treated as a potential health hazard. Exposure to these reagents must be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets must be made available to all personnel involved in these analyses.

5.3 Polychlorinated biphenyls have been classified as known or suspected human or mammalian carcinogens. Primary standards of these toxic compounds must be prepared in a hood. A NIOSH/Mass approved toxic gas respirator should be worn when the analyst handles high concentrations of these toxic compounds.

6.0 INTERFERENCES

6.1 The data from all blanks, samples, and spikes must be evaluated for interferences.

6.2 Cross-contamination of clean glassware routinely occurs when plastics are handled during extraction steps, especially when solvent-wetted surfaces are handled. Glassware must be scrupulously cleaned. Refer to "The Preparation of Glassware for Extraction of organic contaminants" SOP for practices utilized in the extraction department.

6.3 Interferences may be caused by contaminants that are co-extracted from the sample. The extent of the interferences will vary from source to source, which can be grouped into three broad categories.

6.3.1 Contaminated solvents, reagents, or sample processing hardware.

6.3.2 Contaminated GC carrier gas, parts, column surfaces, or detector surfaces.

6.3.3 Compounds extracted from the sample matrix to which the detector will respond.

6.4 Interferences by phthalate esters introduced during sample preparation can pose a major problem in PCB determination.

6.4.1 Common flexible plastics contain varying amounts of phthalate esters which are easily extracted or leached from such materials during laboratory operations. Avoiding contact with any plastic materials and checking all solvents and reagents for phthalate contamination can best minimize interference from phthalate esters.

6.4.2 Exhaustive cleanup of solvents, reagent and glassware may be required to eliminate background phthalate ester contamination.

6.4.3 These materials can be removed through the use of Method 3665 (sulfuric acid/permanganate cleanup).

6.5 Elemental sulfur is readily extracted from soil samples and may cause chromatographic interferences in the determination of PCBs. Method 3660 is suggested for removal of sulfur.

6.6 To reduce carryover when high-concentration samples are sequentially analyzed, the syringe must be rinsed out between samples with solvent. Whenever an unusually concentrated sample is encountered, it should be followed by the analysis of an instrument blank to check for cross contamination.

7.0 SAMPLE PRESERVATION AND HOLDING TIME

7.1 PRESERVATION

7.1.1 Water Samples

7.1.1.1 Collect samples in 1 liter glass amber bottles without preservatives.

7.1.1.2 A liter of an unpreserved sample is required for extraction. Additional sample volume is necessary for any samples used for matrix spike and matrix spike duplicates. Therefore, 3 liters of at least one sample in every group of 20 field samples are required for analysis to accommodate all quality control requirements.

7.1.2 Soil Samples

7.1.2.1 Samples are collected in a 300-ml amber glass sample bottle. No preservative is required.

7.1.3 Sample should be taken with care so as to prevent any portion of the collected sample coming in contact with the sampler's gloves, thus causing possible phthalate contamination.

7.1.4 The samples must be protected from light and refrigerated at $\leq$ 6 °C from the time of receipt until extraction and analysis.

7.2 HOLDING TIME

7.2.1 Aqueous sample must be extracted within 1 year of sampling.

7.2.2 Soil sample must be extracted within 1 year of sampling.

7.2.3 Extracts must be analyzed within 40 days following extraction.

8.0 APPARATUS AND MATERIALS

8.1 GAS CHROMATOGRAPH SYSTEM

8.1.1 Gas Chromatograph-Agilent or Hewlett Packard Model 5890 and 6890. The analytical system complete with a temperature programmable gas chromatograph and all required accessories including syringes, analytical columns, and gases. The injection port is designed for splitless injection with capillary columns. The capillary columns are directly coupled to the detectors.

8.1.2 Columns

8.1.2.1 Column pair 1

8.1.2.1.1 30 m x 0.32 mm fused silica (0.5 µm film thickness) DB-1701 narrow-bore capillary column or equivalent.

8.1.2.1.2 30 m x 0.32 mm fused silica (0,5 µm film thickness) DB-5 narrow-bore capillary column or equivalent.

8.1.2.2 Column pair 2

8.1.2.2.1 30 m x 0.32 mm fused silica (0.5 µm film thickness) RTX CLPI narrow-bore capillary column or equivalent.

8.1.2.2.2 30 m x 0.32 mm fused silica (0.25 µm film thickness) RTX CLPII narrow-bore capillary column or equivalent.

8.1.3 Detectors

8.1.3.1 Electron Capture Detectors (HP).

8.1.3.2 Micro Electron Capture Detectors (HP).

8.2 AUTOSAMPLER

8.2.1 Agilent or Hewlett Packard Model 7673A, 7683, 7643A capable of holding 100 of 2-ml crimp vials.

8.3 DATA SYSTEM

8.3.1 MSD interfaced to the gas chromatograph which allows the continuous acquisition and storage on machine readable media (disc) of all chromatographic data obtained throughout the duration of the analysis.

8.3.2 The ENVIROQUANT data system is capable of quantitation using multi-point calibration.

8.3.3 Lagato Networker with lookup database on 4mm DAT tape for long term, off line magnetic storage of data.

8.4 SYRINGE

8.4.1 Manually held ul-syringes, various volumes (Hamilton or equiv.).

8.4.2 10 µl graduated, auto sampler (Hamilton or equiv.).

9.0 REAGENTS AND STANDARDS

9.1 Refer to Accutest Sample Preparation SOPs EOP001 and EOP040A for reagents and standards used for sample extraction.

9.2 Solvents - Ultra pure, chromatography grade Hexane.

9.3 Stock standard solutions.

9.3.1 Two separate sources of commercially prepared standards with traceability documentation are used. The standards contain Aroclors 1016, 1221, 1232, 1242, 1248, 1254 and 1260.

9.4 Working Solutions

9.4.1 Prepare working solutions, using stock solution, in hexane, as needed, that contain the compounds of interest, either singly or mixed together. Refer to Table 3A, 3B for details.

9.5 Calibration Standards

9.5.1 Initial Calibration Standards

9.5.1.1 A standard containing a mixture of Aroclor 1016 and Aroclor 1260 will include many of the peaks in the other five Aroclor mixtures. As a result, a multi-point calibration employing a mixture of Aroclors 1016 and 1260 at five concentrations should be sufficient to demonstrate the linearity of the detector response without the necessity of performing initial calibration for each of the seven Aroclors. Prepare a minimum of five calibration standards containing equal concentrations of both Aroclor 1016 and Aroclor 1260, including surrogates, by dilution of the above working solutions (Section 9.4) with hexane. Suggested levels and preparations are shown in Table 4A.

9.5.1.2 Separate calibration standards are required for the other five Aroclors. Unless otherwise necessary for a specific project, a single calibration standard near the mid-point of the expected calibration range of each remaining Aroclor is employed to determine its calibration factor and for pattern recognition. Refer to Table 4B for preparation scheme. Optional curves as shown on Table 4C may also be used for a multi-point calibration per project's specification.

9.5.2 Continuing Calibration Verification (CCV)

9.5.2.1 For Aroclor analyses, the continuing calibration checks should be a mixture of Aroclor 1016 and Aroclor 1260. Two standards at 500 µg/l and 1,000 µg/l are prepared as described in Table 5A. During the analysis, these two solutions are alternated to check the initial calibration.

9.5.2.2 In situations where only a few Aroclors are of interest for a specific project, the calibration checks of each Aroclor of interest may be prepared (Table 5B) and analyzed as the 1016/1260 mixture throughout the analytical sequence.

9.6 Initial Calibration Verification (ICV) - Second Source Calibration Check Standard

9.6.1 Prepare the ICV check standards from separate sources of stock standards from the calibration curve following the procedures in Table 6A, and 6B.

9.6.2 The ICV is prepared at 1,000 µg/l for each Aroclor and is analyzed immediately after and initial calibration.

9.7 Surrogates

9.7.1 Tetrachloro-m-xylene (TCMX) and decachlorobiphenyl (DCB) are used as surrogate standards for this method.

9.7.2 A calibration range must be constructed for the surrogate compounds. Accordingly, appropriate amounts of surrogates are mixed with each calibration solution to define a range similar to the target compounds.

9.7.3 Surrogate compounds are also contained in continuing calibration checks, and second source calibration check standard.

9.7.4 Spike each sample, QC sample and blank with an appropriate amount of corresponding surrogate spiking solution, prior to extraction, for a final concentration in the extract of 40 µg/l of each surrogate compound.

9.8 Storage of Standards

9.8.1 Store unopened stock standard solutions according to the manufacturer's documented holding time and storage temperature recommendations. Protect from light.

9.8.2 Store all other working standard solutions in glass vials with Teflon lined screw caps at ≤ 6°C in the dark.

9.8.3 Opened stock standard solutions must be replaced after 6 monts or sooner if manufacturer's expiration date comes first or comparison with quality control check samples indicates a problem.

9.8.4 All other standards must be replaced after six months or sooner if routine QC indicates a problem or manufacturer's expiration date comes first.

10.0 CALIBRATION

10.1 Initial Calibration

10.1.1 The method reporting limit is established by the concentration of the lowest standard analyzed during the initial calibration. Lower concentration standard may be needed to meet the reporting limit requirements of state specific regulatory program. The linear range covered by this calibration is the highest concentration standard.

10.1.2 The initial calibration for this method consists of two parts, described below.

10.1.2.1 A standard containing a mixture of Aroclor 1016 and Aroclor 1260 will include many of the peaks represented in the other five Aroclor mixtures. Thus, such a standard may be used to demonstrate the linearity of the detectors and that a sample does not contain peaks that represent any one of the Aroclors. This standard can also be used to determine the concentrations of either Aroclor 1016 or Aroclor 1260, should they be present in a sample. The calibration range covered for Aroclor 1016 and Aroclor 1260 employs standards of 50, 250, 500, 1,000, 2,000, and 3,000 µg/l.

10.1.2.2 Standards of the other five Aroclors are necessary for pattern recognition. These standards are also used to determine a single-point calibration factor for each Aroclor, assuming that the Aroclor 1016/1260 mixture in Section 10.1.2.1 has been used to describe the detector response. The concentration of each Aroclor standard is near the mid-point of the linear range of the detector, usually at 1,000 µg/l. The standards for these five Aroclors should be analyzed before the analysis of any samples, and may be analyzed before or after the analysis of those 1016/1260 standards.

10.1.2.3 In situations where only a few Aroclors are of interest for a specific project, an initial calibration of a minimum of five standards of each Aroclors of interest instead of the 1016/1260 mixture may be performed.

10.1.3 A calibration range must be constructed for each surrogate compound. Accordingly, add appropriate amounts of each surrogate compound to the calibration solution to define a range similar to the target compounds.

10.1.4 Aliquot proper amount of each calibration standard into a 2 ml crimp top vial.

10.1.5 PCBs are quantitatively determined as Aroclors by the external standard technique. The Calibration Factor (CF) for each characteristic Aroclor peak in each of the initial calibration standards is calculated using the equation in Section 14.1.

10.1.5.1 Use at least five peaks for the Aroclor 1016/1260 mixture, none of which should be found in both of these Aroclors. At least five sets of calibration factors will be generated, each set consisting of the calibration factors for each of the five (or more) peaks chosen for this mixture.

10.1.5.2 A minimum of 3 characteristic peaks must be chosen for each of the other Aroclors, and preferably 5 peaks. The peaks must be characteristic of the Aroclor in question. Thus, each single standard will generate at least three calibration factors, one for each selected peak.

10.1.5.3 Choose peaks in the Aroclor standards that are at least 25% of the height of the largest Aroclor peak. For each Aroclor, the set of 3 to 6 peaks should include at least one peak that is unique to that Aroclor.

10.1.5.4 The calibration factors from the initial calibration are used to evaluate the linearity of the initial calibration. When the Aroclor 1016/1260 mixture is used to demonstrate the detector response, the calibration model chosen for this mixture must be applied to the other five Aroclors for which only single

standards are analyzed. If multi-point calibration is performed for individual Aroclors, use the calibration factors from those standards to evaluate linearity.

10.1.6 For the initial calibration to be valid, the percent relative standard deviation (% RSD) (see Section 14.2) must be less than 20 % for each Aroclor of interest on each column. If any analyte exceeds the 20% acceptance limit for a given calibration, corrective action must be taken.

10.1.6.1 If the problem is associated with specific standards, reanalyze the standard and recalculate the RSD.

10.1.6.2 Alternatively, narrow the calibration range by replacing one or more of the calibration standards that cover a narrow range.

10.1.6.2.1 The changes to the upper end of the calibration range will affect the need to dilute samples above the range. If the instrument response indicates signs of detector saturation, the concentration of the standard at the upper limit will be reduced. The changes to the lower end will affect the overall sensitivity of the method. Consider the regulatory limits or action levels associated with the target analytes when adjusting the lower end of the range.

10.2 Initial Calibration Verification (ICV) - Second Source Calibration Check Standard

10.2.1 The initial calibration is verified with an ICV, a second source calibration check standard from an external source (Section 9.6). It must be performed right after the initial calibration.

10.2.2 The percent difference (%D) (Section 14.3) for this standard must meet the %D criteria of 20% used for calibration verification on each column.

10.2.2.1 If %D is greater than 20%, reanalyze the second source check. If the limit cannot be met upon re-injection, re-prepare the second source solution using a fresh ampoule and repeat the process.

10.2.2.2 If the %D criteria cannot be achieved after re-preparation of the second source, prepare a third source and repeat the process. Make fresh calibration standards using one of the two standard sources that match each other.

10.3 Continuing Calibration Verification (CCV)

10.3.1 Continuing calibration verification (CCV) standards (Section 9.5.2) must be acquired at the beginning of each 12-hour shift, after every 10 injections not to exceed 12 hours and at the end of the analysis sequence. The 500 µg/l check standard is alternated with 1,000 µg/l standard for calibration verification.

10.3.2 For Aroclor analyses, the calibration verification standard should be a mixture of Aroclor 1016 and Aroclor 1260. The calibration verification process does not require analysis of the other Aroclor standards used for pattern recognition, but the analyst may wish to include a standard for one of these Aroclors after the 1016/1260 mixture used for calibration verification throughout the analytical sequence.

10.3.3 The percent difference (%D) (see section 14.3) must be less than 20% for each Aroclor of interest on each column.

10.3.4 Each sample analysis must be bracketed by periodic analyses of acceptable calibration verification standards every 10 injections not to exceed 12 hours. If %D criteria fails during a mid sequence calibration check or at the end of the analysis sequence, a continuing calibration check is allowed to be repeated only once; if the second trial fails, a new initial calibration must be performed. In situations where the first check fails to meet the criteria, the instrument logbook should have clear documented notations as to what the problem was and what corrective action was implemented to enable the second check to pass.

10.3.5 A continuing calibration standard is analyzed whenever the analyst suspects that the analytical system is out of calibration. If the calibration cannot be verified, corrective action is performed to bring the system into control. Analysis may not continue until the system is under control.

10.3.6 When a calibration verification standard fails to meet the QC criteria at the end of the analysis sequence, all samples injected after the last standard that met the QC criteria must be evaluated to prevent mis-quantitations, and re-injection of the sample extracts may be required.

10.3.6.1 If the analyte was not detected in the specific samples analyzed during the analytical shift or sequence, the extracts for those samples do not need to be reanalyzed when the calibration standard response is above the initial calibration response.

10.3.6.2 If the analyte was detected in the specific samples analyzed during the analytical shift or sequence, or the calibration standard response is below the initial calibration response, then the extracts for those samples need to be reanalyzed.

10.3.7 Each subsequent injection of a continuing calibration standard during the 12-hour analytical shift must be checked against the retention time windows established in Section 11.0. If any of these subsequent standards fall outside their absolute retention time windows, the GC system is out of control. Determine the cause of the problem and correct it. If the problem cannot be corrected, a new initial calibration must be performed.

11.0 RETENTION TIME WINDOWS

11.1 Absolute retention times are used for the identification of PCBs as Aroclors. Retention time windows must be calculated for each surrogate and at least 3 to 5 characteristic peaks of each Aroclor on each GC column, when a new initial calibration is run and whenever a new chromatographic column is installed, or when there are significant changes in the operating conditions. The retention time windows must be reported with the analysis results in support of the identifications made.

11.2 Employ the following approach to establish retention time windows:

11.2.1 Make three injections of each Aroclor at approximately equal intervals during the 72-hr period.

11.2.2 For each Aroclor, choose three or five major peaks and calculate the mean and standard deviation of the three retention times for that peak. The peak chosen should be fairly immune to losses due to degradation and weathering in the samples. Record the retention time to three decimal places (e.g. 10.015 min) for each Aroclor.

11.2.3 In those cases where the standard deviations of the retention time window for a particular Aroclor is 0.01 minutes or less, the laboratory may either collect data from additional injections of standards or use a default standard deviation of 0.01 minutes.

11.2.4 Apply plus or minus three times the standard deviations to retention time of each Aroclor standard (continuing calibration or middle level of initial calibration). This will be used to define the retention time window for the sample.

11.2.4.1 If default standard deviation of 0.01 minutes is employed, the width of the window will be 0.03 minutes.

11.2.5 Establish the center of the retention time window for each Aroclor and surrogate by using the absolute retention time for each Aroclor and surrogate from the calibration verification standard at the beginning of the analytical shift. For samples run during the same shift as an initial calibration, use the retention time of the mid-point standard of the initial calibration.

11.2.6 When retention time windows are to be determined, analyze a standard containing DDT analogs to ensure that they do not elute at the same retention time as the last major Aroclor 1254 peak. The analyst must either adjust the GC conditions for better resolution, or choose another peak that is characteristic of the Aroclor and which does not elute at the same time as of the DDT analogs.

12.0 PROCEDURE

12.1 Sample Extraction

12.1.1 In general, water samples are extracted at a neutral pH with methylene chloride using a separate funnel (Method 3510) (Refer to SOP: EOP001). Solid samples are extracted using Method 3545A, Pressurized Fluid Extraction (Refer to SOP: EOP040A).

12.2 Sample Cleanup

12.2.1 Cleanup procedures may not be necessary for a relatively clean sample matrix, but most extracts from environmental and waste samples will require additional preparation before analysis. The specific cleanup procedure used will depend on the nature of the sample to be analyzed and the data quality objectives for the measurements. Refer to appropriate SOPs for details.

12.2.1.1 Interferences by phthalate esters can be removed through the use of a sulfuric acid/potassium permanganate cleanup (Method 3665) designed specifically for

PCBs. This method should be used whenever elevated baselines or overly complex chromatograms prevent accurate quantitation of PCBs.

12.2.1.2 Element sulfur, which may be present in certain sediments and industrial wastes, interfere with the electron capture gas chromatography of certain Aroclors. Sulfur should be removed by the technique described in Method 3660.

12.3 Instrument conditions.

12.3.1 Recommended instrument conditions are listed in Table 2. Modifications of parameters specified with an asterisk are allowed as long as criteria of calibration are met. Any modification should be approved by team leader/manager.

12.4 Initial calibration

12.4.1 Refer to Section 10.1.

12.5 Initial calibration Verification (ICV) -Second source calibration check standard

12.5.1 Refer to Section 10.2.

12.6 Continuing calibration Verifications (CCV)

12.6.1 Refer to Section 10.3.

12.7 Sample analysis (Primary)

12.7.1 All samples and quality control samples are injected into the Gas Chromatograph using the autosampler. Program the sampler for an appropriate number of syringe rinses and a 1ul or 2 µl injection size. A splitless injection technology is used.

12.7.2 Sample concentrations are calculated by comparing sample responses with the initial calibration of the system (Section 14.4). If sample response exceeds the limits of the initial calibration range, dilute the extract and reanalyze. Extracts should be diluted so that all peaks are on scale, as overlapping peaks are not always evident when peaks are off scale.

12.7.3 Sample injections may continue for as long as the calibration verification standards and standards interspersed with the sample meet instrument QC requirements. The sequence ends when the set of samples has been injected or when qualitative and/or quantitative QC criteria are exceeded.

12.7.4 If the peak response is less than 2.5 times the baseline noise level, the validity of the quantitative result may be questionable. The analyst should consult with the source of the sample to determine whether further concentration of the sample is warranted.

12.7.5 If compound identification or quantitation is precluded due to interference (e.g., broad, rounded peaks or ill-defined baselines are present) cleanup of the extract or replacement of the capillary column or detector is warranted. Rerun the sample on another instrument to determine if the problem results from analytical hardware or the sample matrix.

12.8 Confirmation analysis.

12.8.1 Confirmation analysis is to confirm the presence of Aroclors tentatively identified in the primary analysis.

12.8.1.1 All instrument performance quality control criteria for calibration and retention time must be satisfied on the confirmation analysis.

12.8.2 Each tentative identification must be confirmed: using a second GC column of dissimilar stationary phase (as in the dual-column analysis), based on a clearly identifiable Aroclor pattern, or using another technique such as GC/MS.

12.8.2.1 The primary and secondary analysis is conducted simultaneously in the dual-column analysis.

12.8.2.2 GC/MS confirmation may be used in conjunction with dual-column analysis if the concentration is sufficient for detection in GC/MS, normally a concentration of approximately 10 ng/µl in the final extract for each Aroclor is required. Method 8270 is recommended as a confirmation technique when sensitivity permits.

12.8.3 Once the identification has been confirmed, the agreement between the quantitative results on both columns should be checked.

12.9 Sample Dilution

12.9.1 Establish dilution of sample in order to fall within calibration range or to minimize the matrix interference.

- Utilize screen data (specific project only).
- Utilize acquired sample data.
- Utilize the history program or approval from client/project.
- Sample characteristics (appearance, odor).

12.9.2 If no lower dilution has been reported, the dilution factor chosen should keep the response of the largest peak for a target analyte in the upper half of the initial calibration range of the instrument.

12.9.3 Preparing Dilutions.

12.9.3.1 Prepare sample dilutions quantitatively. Dilute the stored sample extract if available with hexane using logical volume to volume ratios, i.e., 1:5, 1:10, 1:50, etc.

12.9.3.2 Syringe Dilutions - A calibrated 1ml syringe must be used to prepare dilutions. Gently shake to disperse the extract throughout the solvent prior to loading on the auto-sampler tray for further analysis.

12.9.3.3 Volumetric Flask Dilutions – Dilutions can also be made with a Class A volumetric flask. Measure appropriate sample extract volume in a calibrated syringe and bring to a final volume with dilution solvent in a Class A volumetric flask. Gently shake to disperse the extract throughout the solvent prior to loading on the auto-sampler tray for further analysis.

12.10 Data interpretation

12.10.1 Qualitative identification

12.10.1.1 Analyst shall identify the target analytes with competent knowledge interpreting retention time and/or chromatographic pattern by comparison of the sample to the standard of the suspected Aroclor. The criteria required for a positive identification are:

12.10.1.1.1 The quantitation of PCB residues as Aroclors is accomplished by comparison of the sample chromatogram to that of the most similar Aroclor standard. A choice must be made as to which Aroclor is most similar to that of the residue and whether that standard is truly representative of the PCBs in the sample.

12.10.1.1.2 The target analytes must elute within the daily absolute retention time window on both primary and confirmation column.

12.10.1.1.3 For PCBs, at least five major peaks are selected. The retention time window for each peak is determined from the initial calibration analysis. This identification of PCBs as Aroclors is based on agreement between the retention times of peaks in the sample chromatogram with the retention time windows established through the analysis of standards of multi-component target analytes. Tentative identification of an analyte occurs when a peak from a sample extract falls within the established retention time window for a specific target analyte.

12.10.1.1.4 Be aware of matrix interfering effects on peak shape and relative peak ratios which could distort the pattern. Interpretation of this phenomenon may require a highly experienced chromatographer or at least a second opinion.

12.10.2 Quantitative analysis

12.10.2.1 Once the Aroclor pattern has been identified, compare the responses of at least 3 major peaks in the single-point calibration standard for that Aroclor with the peaks observed in the sample extract. The amount of Aroclor is calculated using the individual calibration factor for each corresponding peak

and the linear calibration established from the multi-point calibration of the 1016/1260 mixture. A concentration (see section 14.4) based on the integrated area/or height of each of the characteristic peaks is determined and then those resulting concentrations are averaged to provide the final result for the sample.

12.10.2.2 Weathering of PCBs in the environment and changes resulting from waste treatment processes may alter the PCBs to the point that the pattern of a specific Aroclor is no longer recognizable. The quantitation may then be performed by measuring the total area of the PCB pattern and quantitating on the basis of the Aroclor standard that is most similar to the sample. Any peaks that are not identifiable as PCBs on the basis of retention times should be subtracted from the total area. When quantitation is performed in this manner, the problems should be fully described for the data user and the specific procedures employed by the analyst should be thoroughly documented.

12.10.2.3 When sample results are confirmed using two dissimilar columns or with two dissimilar detectors, the agreement between the quantitative results must be evaluated after the identification has been confirmed. Calculate the relative percent difference (RPD) between the two results using the formula in Section 14.6. The lower result is reported.

12.10.2.3.1 If one result is significantly higher (e.g., >40%), check the chromatograms to see if an obviously overlapping peak is causing an erroneously high result. If no overlapping peaks are noted, examine the baseline parameters established by the instrument data system (or operator) during peak integration.

12.10.2.3.2 If no anomalies are noted, review the chromatographic conditions. If there is no evidence of chromatographic problems, report the lower result with the footnote (remark) indicating "More than 40% RPD for detected concentrations between two GC columns".

13.0 QUALITY CONTROL

13.1 QC Requirements Summary

Initial Calibration	Whenever needed
Initial Calibration Verification (ICV)	Following initial calibration
Continuing Calibration Verifications (CCV)	Every 12-hour shift , after every 10 samples and at the end of analysis sequence
Method blank	One per extraction batch*
Blank Spike	one per extraction batch*
Matrix Spike	one per extraction batch*
Matrix Spike Duplicate	one per extraction batch*
Surrogates	every sample and standard

*The maximum number of samples per batch is twenty or per project specification.

13.2 Initial Calibration.

13.2.1 Refer to Section 10.1.

13.3 Initial Calibration Verification (ICV) -Second Source Calibration Check.

13.3.1 Refer to Section 10.2.

13.4 Continuing Calibration Verifications (CCV)

13.4.1 Refer to Section 10.3.

13.5 Method Blank.

13.5.1 The method blank is either DI water or sodium sulfate (depending upon the sample matrix) which must be extracted with each set of 20 or less samples. For a running batch, a new method blank is required for each different extraction day. The method blank should be carried through all stages of the sample preparation and measurement.

13.5.2 If the method blank contains a target analyte above its MDL established by the laboratory, the entire batch must be re-extracted and reanalyzed.

13.5.3 Surrogate compounds are added to the method blank prior to extraction and analysis. If the surrogate accuracy in the blank does not meet criteria established by the laboratory, the entire batch must be re-extracted and reanalyzed.

13.6 Blank Spike (Laboratory Control Sample)

13.6.1 A blank spike must be extracted with each set of 20 or less samples. For a running batch, a new blank spike is required for each different day. The blank spike consists of an aliquot of a clean (control) matrix similar to the sample matrix and of the same weight or volume. It is spiked with the same analyte at the same concentration as matrix spike. When the presence of specific Aroclors is not anticipated, the Aroclor 1016/1260 mixture may be appropriate choice for spiking. In situations where the other Aroclors are of interest for a specific project, the analyst may employ different spiking mixtures. The blank spike is prepared at a concentration of 2 µg/l or 66.7 µg/kg (on a dry weight basis) for each Aroclor.

13.6.2 The blank spike recoveries should be assessed using in house limits established by the laboratory.

13.6.3 If a blank spike is out of control, the following corrective actions must be taken. In the case where the blank spike recovery is high and no hits reported in associated samples and QC batch the sample results can be reported with footnote (remark) and no further action is required.

13.6.3.1 Check to be sure that there are no errors in the calculations, or spike solutions. If errors are found, recalculate the data accordingly.

13.6.3.2 Check instrument performance. If an instrument performance problem is identified, correct the problem and reanalyze the sample batch.

13.6.3.3 If no problem is found, re-extract and reanalyze the sample batch.

13.7 Matrix Spike (MS) / Matrix Spike Duplicate (MSD).

13.7.1 One sample is randomly selected from each extraction batch and spiked in duplicate with select Aroclors to assess the performance of the method as applied to a particular matrix and to provide information on the homogeneity of the matrix. Both the MS and MSD are carried through the complete sample preparation, cleanup, and determinative procedures.

13.7.2 The MS and MSD should be spiked with the Aroclors of interest. If samples are not expected to contain target analytes, a matrix spike and matrix spike duplicate pair should be spiked with Aroclor 1016/1260 mixture. However, when specific Aroclors are known to be present or expected in samples, the specific Aroclor should be used for spiking.

13.7.3 Matrix spikes are prepared by spiking an actual sample at a concentration 2 µg/l or 66.7µg/kg on a dry weight basis.

13.7.4 Assess the matrix spike recoveries and relative percent difference (RPD) against the control limits established by the laboratory.

13.7.5 If the matrix spike accuracy of any individual Aroclor is out of control, the accuracy for that Aroclor in the blank spike must be within control. Matrix interference is assumed and the data is reportable. No further corrective action is required.

13.8 Surrogates.

13.8.1 Tetrachloro-m-xylene (TCMX) and Decachlorobiphenyl (DCB) are used as surrogate standards. All blanks, samples, matrix spikes, and calibration standards contain surrogate compounds which are used to monitor performance of the extraction, cleanup (when used), and analytical system.

13.8.2 The recoveries (Section 14.5) of the surrogates must be evaluated versus the surrogate control limits developed by the laboratory annually.

13.8.3 If surrogate recoveries are not within established control limits, corrective action must be performed if surrogate recoveries indicate that a procedural error may have occurred during the analysis of the sample.

13.8.3.1 Check the surrogate calculations for calculation or integration errors and perform corrections if detected.

13.8.3.2 Reanalyze the extract if no calculation errors are detected. If the surrogate recoveries for the reanalyzed extract are in control, report the data from the reanalysis only.

13.8.3.3 If the data from the reanalysis is also out of control, re-extract and reanalyze the sample.

13.8.3.4 If, upon reanalysis, the surrogate recoveries are acceptable, report the reanalysis data. If the holding time has expired prior to the reanalysis, report both the original and reanalysis results and note the holding time problem.

13.8.3.5 If the recovery is again not within limits, the problem is considered to be matrix interference. Submit both data sets with the original analysis being reported.

13.8.4 The retention time shift for surrogate must be evaluated after the analysis of each sample. The sample must be reanalyzed when the retention times for both surrogates are outside the retention time window.

13.8.4.1 Reanalyses are not required for samples having visible matrix interference, defined as excessive signal levels from target or non-target interfering peaks. This judgment should be approved by a team leader or supervisor.

13.9 Refer to Project Specific Bench Notes(GC8082) for additional program or client specific QC requirements.

14.0 CALCULATION

14.1 Calibration Factor (CF).

$$CF = \frac{A_s}{C_s}$$

where:
A_s = Area of the peak for the compound being measured.
C_s = Concentration of the compound being measured (µg/l).

14.2 Percent Relative Standard Deviation (% RSD).

$$\%RSD = \frac{SD}{CF_{av}} \times 100$$

where:
SD = Standard Deviation.
CF_{av} = Average calibration factor from initial calibration.

14.3 Percent Difference (% D).

$$\% D = \frac{|CF_{av} - CF_c|}{CF_{av}} \times 100$$

where:
CF_c = CF from continuing calibration (CBCHK).

14.4 Concentration (Conc.).

For water:

$$\text{Conc. } (\mu g/l) = \frac{A_c \times M}{CF_{av}}$$

$$M = \frac{V_f \times D}{V_i}$$

For soil/sediment (on a dry weight basis, see SOP EGN007):

$$\text{Conc. } (\mu g/kg) = \frac{A_c \times M}{CF_{av}}$$

$$M = \frac{V_f \times D}{W_s \times S}$$

where:
A_c = Area of peak for compound being measured.
V_f = Final Volume of total extract (ml).
D = Secondary dilution factor.
V_i = Initial volume of water extracted (ml).
W_s = Weight of sample extracted (g).
S = (100 - % moisture in sample) / 100 or % solid/100.
M = Multiplier.

14.5 Percent Recovery (% R).

$$\%\ R = \frac{\text{Concentration found}}{\text{Concentration spiked}} \times 100$$

14.6 Relative Percent Difference (RPD).

$$RPD = \frac{|C_1 - C_2|}{(1/2)(C_1 + C_2)} \times 100$$

where:
C_1 = Matrix Spike Concentration or the result on column 1.
C_2 = Matrix Spike Duplicate Concentration or the result on column 2.

15.0 DOCUMENTATION

15.1 The Analytical Logbook is a record of the analysis sequence; the logbook must be completed daily. Each instrument will have a separate logbook.

15.1.1 If samples require reanalysis, a brief explanation of the reason must be documented in this log. For consistency, if surrogates are high or low indicate it as (↑) for high and (↓) for low.

15.2 The Standard Preparation Logbook must be completed for all standard preparations. All information requested must be completed, the page must be signed and dated by the respective person.

15.2.1 The Accutest Lot Number must be cross-reference on the standard vial.

15.3 The Instrument Maintenance Logbook must be completed when any type of maintenance is performed on the instrument. Each instrument will have a separate log.

15.4 Any corrections to laboratory data must be done using a single line through the error. The initials of the person and date of correction must appear next to the correction.

15.5 Unused blocks of any form must be x'ed and z'ed by the analyst before submitting the data for review.

15.6 Supervisory (or peer) personnel must routinely review (at least once per month) all laboratory logbooks to ensure that information is being recorded properly. Additionally, the maintenance of the logbooks and the accuracy of the recorded information should also be verified during this review.

16.0 DATA REVIEW AND REPORTING

16.1 Initial and continuing calibration check. Verify that all calibration and continuing calibration criteria have been achieved. If the criteria had not been achieved, corrective action must be performed to bring the system in control before analyzing any samples.

16.1.1 If samples had been analyzed under non-compliant calibration criteria, all sample extracts must be re-analyzed once the system is brought into control.

16.2 Quality Control Data Review. Review all QC data. If QC criteria were not achieved, perform corrective action before proceeding with analysis.

16.2.1 In some situation, corrective action may demand that the entire sample batch be re-extracted and re-analyzed before processing data.

16.3 Chromatogram Review. The chromatogram of each sample is evaluated for target analytes.

16.3.1 Check specific retention time windows for each target compound for the presence of the target compound in each chromatogram.

16.3.1.1 Each sample may require the reporting of different target analytes. Review the login to assure that the correct target compounds are identified.

16.3.2 The Aroclor must be identified on the primary and confirmatory column before assigning a qualitative identification.

16.3.3 Manual integration of chromatographic peaks must be identified by the analysts. An electronic signature is applied upon data review.

16.4 Transfer to LIMS. Following the initial screen review, transfer the processed data to the LIMS.

17.0 POLLUTION PREVENTION & WASTE MANAGEMENT

17.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 17.2.

17.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, EHS004. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:

17.2.1 Non hazardous aqueous wastes.

17.2.2 Hazardous aqueous wastes

17.2.3 Chlorinated organic solvents

17.2.4 Non-chlorinated organic solvents

17.2.5 Hazardous solid wastes

17.2.6 Non-hazardous solid wastes

Table 1. PCB Aroclors and Reporting Limits				
Compound	CAS Number	Water (µg/l)	Soil (µg/kg)	Oil (µg/kg)
Arochlor – 1016	12674-11-2	0.5	30	2000
Arochlor – 1221	11104-28-2	0.5	30	2000
Arochlor – 1232	11141-16-5	0.5	30	2000
Arochlor – 1242	53469-21-9	0.5	30	2000
Arochlor – 1248	12672-29-6	0.5	30	2000
Arochlor – 1254	11097-69-1	0.5	30	2000
Arochlor – 1260	11096-82-5	0.5	30	2000

Table 2. RECOMMENDED OPERATING CONDITION	
Gas Chromatograph/Electron Capture Detectors	
Carrier Gas	Helium
Make-up gas	5 % Methane/ 95 % Argon
Make-up gas flow	*30 ml/min
Injection port temperature	*235 °C
Injection type	Splitless
Detector temperature	*320 °C
Column flow	*5 ml/min
Gas Chromatograph Temperature Program*	
Initial temperature	*170 °C
Time 1	*2 min
Column temperature rate 1	*30 degrees/min
Temperature 1	*180 °C
Column temperature rate 2	*3.5 degrees/min
Temperature 2	*240 °C
Column temperature rate 3	*10 degrees/min
Final temperature	*280 °C
Time 3	*5 min
Total run time	30-40 min

* Parameter modification allowed for performance optimization as long as QC criteria are achieved.

Table 3A. Aroclors 1016/1260 Mixture and Surrogates Working Solution	
Stock Solution	**Volume Added**
Aroclor 1016/1260 (1,000 µg/ml)	500 µl
Pesticides Surrogate Std Spiking Solution (200 µg/ml)	100 µl
Hexane	fill to volume
Total	25.0 ml

- Aroclors 1016/1260 (20 µg/ml) and Surrogates (0.8 µg/ml) Working Solution: Prepared by measuring 500 µl of 1,000 µg/ml Aroclor 101/1260 and 100µ of 200 µg/ml pesticides surrogate std spiking solution and bringing to 25 ml with hexane.

Table 3B. Individual Aroclor* and Surrogates Working Solution	
Stock Solution	**Volume Added**
Individual Aroclor* (1,000 µg/ml)	500 µl
Pesticides Surrogate Std Spiking Solution (200 µg/ml)	100 µl
Hexane	24.4 ml
Total	25 ml

*Aroclor: 1221, 1232, 1242, 1248, 1254, 1262 & 1268

- Individual Aroclor (20 µg/ml) and Surrogates (0.8 µg/ml) Working Solution: Prepared by measuring 500 µl of 1,000 µg/ml each individual Aroclor, 100 µl of 200 µg/ml pesticides surrogate std spiking solution and bringing to 25 ml with hexane.

Table 4A. Aroclors 1016/1260 Calibration Standard Solutions					
Standard	**Working Solution**	**Concentration (µg/ml)**	**Volume Added (µl)**	**Final Volume In Hexane (ml)**	**Final Concentration(µg/l)**
Standard A	Aroclors 1016/1260	20	62.5	25	50
	Surrogates	0.8			2
Standard B	Aroclors 1016/1260	20	312.5	25	250
	Surrogates	0.8			10
Standard C	Aroclors 1016/1260	20	625	25	500
	Surrogates	0.8			20
Standard D	Aroclors 1016/1260	20	1250	25	1,000
	Surrogates	0.8			40
Standard E	Aroclors 1016/1260	20	2,500	25	2,000
	Surrogates	0.8			80
Standard F	Aroclors 1016/1260	20	3,750	25	3,000
	Surrogates	0.8			120

- Standard A: Prepared by measuring 62.5 µl of Aroclors 1016/1260 Mixture and Surrogates Working Solution (Table 3A), and bringing to 25 ml with hexane.
- Standard B: Prepared by measuring 312.5 µl of Aroclors 1016/1260 Mixture and Surrogates Working Solution (Table 3A), and bringing to 25 ml with hexane.
- Standard C: Prepared by measuring 625 µl of Aroclors 1016/1260 Mixture and Surrogates Working Solution (Table 3A), and bringing to 25 ml with hexane.
- Standard D: Prepared by measuring 1,250 µl of Aroclors 1016/1260 Mixture and Surrogates Working Solution (Table 3A), and bringing to 25 ml with hexane.
- Standard E: Prepared by measuring 2,500 µl of Aroclors 1016/1260 Mixture and Surrogates Working Solution (Table 3A), and bringing to 25 ml with hexane.
- Standard F: Prepared by measuring 3,750 µl of Aroclors 1016/1260 Mixture and Surrogates Working Solution (Table 3A), and bringing to 25 ml with hexane.

Table 4B. Single-Point Calibration Standard (1,000 µg/l) for Individual Aroclor*	
Stock Solution	**Volume Added**
Individual Aroclor*/Surrogate Working Solution (20 µg/ml/0.80µg/ml) (Table 3B)	1,250 µl
Hexane	23.75 ml
Total	25 ml

* Aroclor: 1221, 1232, 1242, 1248, 1254, 1262, & 1268.

- Individual Aroclor Calibration Standard (1,000 µg/l) and Surrogates (40 µg/l) Solution: Prepared by measuring 1,250 µl of individual Aroclor and surrogates working solution, containing 20 µg/ml of each corresponding Aroclor and 0.80 µg/ml of both surrogate compounds, and bringing to 25 ml with hexane.

Table 4C. Multi-point Calibration Standards for Individual Aroclor* (optional)					
Standard	**Stock Solution**	**Concentration (µg/ml)**	**Volume Added (µl)**	**Final Volume in Hexane (ml)**	**Final Concentration(µg/l)**
Standard A	Aroclor*	20	62.5	25	50
	Surrogates	0.8			2
Standard B	Aroclor*	20	312.5	25	250
	Surrogates	0.8			10
Standard C	Aroclor*	20	625	25	500
	Surrogates	0.8			20
Standard D	Aroclor*	20	1250	25	1,000
	Surrogates	0.8			40
Standard E	Aroclor*	20	2,500	25	2,000
	Surrogates	0.8			80
Standard F	Aroclor*	20	3,750	25	3,000
	Surrogates	0.8			120

*Aroclor: 1221, 1232, 1242, 1248, 1254, 1262, & 1268.

- Standard A: Prepared by measuring 62.5 µl of Individual Aroclor and Surrogates Working Solution (Table 3B), and bringing to 25 ml with hexane.
- Standard B: Prepared by measuring 312.5 µl of Individual Aroclor and Surrogates Working Solution (Table 3B), and bringing to 25 ml with hexane.
- Standard C: Prepared by measuring 625 µl of Individual Aroclor and Surrogates Working Solution (Table 3B), and bringing to 25 ml with hexane.
- Standard D: Prepared by measuring 1,250 µl of Individual Aroclor and Surrogates Working Solution (Table 3B), and bringing to 25 ml with hexane.
- Standard E: Prepared by measuring 2,500 µl of Individual Aroclor and Surrogates Working Solution (Table 3B), and bringing to 25 ml with hexane.
- Standard F: Prepared by measuring 3,750 µl of Individual Aroclor and Surrogates Working Solution (Table 3B), and bringing to 25 ml with hexane.

Table 5A. Continuing Calibration Check Solutions for Aroclors 1016/1260					
Checks	**Working Solution**	**Concentration (µg/ml)**	**Volume Added (µl)**	**Final Volume in Hexane (ml)**	**Final Concentration (µg/l)**
Solution 1	Aroclors 1016/1260	20	625	25	500
	Surrogates	0.8			20
Solution 2	Aroclors 1016/1260	20	1250	25	1,000
	Surrogates	0.8			40

- Solution 1: Prepared by measuring 625 µl of Aroclors 1016/1260 Mixture and Surrogates Working Solution (Table 3A), and bringing to 25 ml with hexane.

- Solution 2: Prepared by measuring 1,250 µl of Aroclors 1016/1260 Mixture and Surrogates Working Solution (Table 3A), and bringing to 25 ml with hexane.

Table 5B. Continuing Calibration Check Solutions for Individual Aroclor*					
Checks	**Working Solution**	**Concentration (µg/ml)**	**Volume Added (µl)**	**Final Volume in Hexane (ml)**	**Final Concentration (µg/l)**
Solution 1	Aroclor*	20	625	25	500
	Surrogates	0.8			20
Solution 2	Aroclor*	20	1250	25	1,000
	Surrogates	0.8			40

* Aroclor: 1221, 1232, 1242, 1248, 12541262, & 1268

- Solution 1: Prepared by measuring 625 µl of Individual Aroclor and Surrogates Working Solution (Table 3B), and bringing to 25 ml with hexane.

- Solution 2: Prepared by measuring 1,250 µl of Individual Aroclor and Surrogates Working Solution (Table 3B), and bringing to 25 ml with hexane.

Table 6A. Second Source Calibration Check Standard for Aroclors 1016/1260 (1,000 µg/l)	
Stock Solution	**Volume Added**
Aroclors 1016/1260 (25 µg/ml) and Surrogates (2.5 µg/ml) Working Solution	1,000 µl
Hexane	24 ml
Total	25 ml

- Aroclors 1016/1260 (25 µg/ml) and Surrogates (2.5 µg/ml) Working Solution: Prepared by measuring 250 µl of 1,000 µg/ml Aroclors 1016/1260 mix solution (2nd source), 125 µl of 200 µg/ml pesticides surrogate std spiking solution and bringing to 10 ml with hexane.

- Aroclors 1016/1260 (1,000 µg/l) and Surrogates (100 µg/l) Solution: Prepared by measuring 1,000 µl of Aroclors 1016/1260 (25 µg/ml) and surrogates (2.5 µg/ml) working solution and bringing to 25 ml with hexane.

Table 6B. Second Source Calibration Check Standard for Individual Aroclor* (1,000 µg/l)	
Stock Solution	**Volume Added**
Individual Aroclor* (25 µg/ml) and Surrogates (2.5 µg/ml) Working Solution	1,000 µl
Hexane	24 ml
Total	25 ml

*Aroclor: 1221, 1232, 1242, 1248, 1254, 1262 & 1268

- Individual Aroclor (25 µg/ml) and Surrogates (2.5 µg/ml) Working Solution: Prepared by measuring 250 µl of 1,000 µg/ml each individual Aroclor stock solution (2nd source), 125 µl of 200 µg/ml pesticides surrogate std spiking solution and bringing to 10 ml with hexane.

- Individual Aroclor (1,000 µg/l) and Surrogates (100 µg/l) Solution: Prepared by measuring 1,000 µl of each individual Aroclor (25 µg/ml) and surrogates (2.5 µg/ml) working solution and bringing to 25 ml with hexane.

ACCUTEST LABORATORIES
STANDARD OPERATING PROCEDURE

Lab Manager: Nancy Cole

QA Manager:

Effective Date: 5/12/11

TITLE: COLD VAPOR ANALYSIS OF MERCURY FOR WATER SAMPLES

REFERENCE: EPA 245.1, revision 3.0 (1994) and SW846 7470A (modified)

Revised Sections: *8.1, 11.1(all), 11.4, 11.5, 11.7, 11.10, 16.1 Added Section 12, renumbered remaining sections*

1.0 SCOPE AND APPLICATION

1.1 This method can be applied for the analysis of mercury for all potable and non-potable water samples. This SOP is based on the May 1994 revision of EPA method 245.1. The reporting limit for mercury water samples based on the procedures outlined in this SOP, is 0.0002 mg/l.

1.2 Aqueous wastewater may also be analyzed following method 7470A. The modification to this method are a direct scale-down of the reagents and the use of an automated analyzer.

2.0 SUMMARY

2.1 Cold vapor mercury is a flameless AA procedure based on the absorption of radiation at 253.7 by mercury vapor. Organic mercury compounds are oxidized and the mercury is reduced to the elemental state and aerated from solution in a closed system. The mercury vapor passes through a cell positioned in the light path of an atomic absorption spectrophotometer. Results are quantitated by comparison to a daily calibration curve.

3.0 REPORTING LIMIT AND METHOD DETECTION LIMIT

3.1 Reporting Limit. The reporting limit for this method is established at the lowest concentration standard in the calibration curve. Detected concentrations below this concentration cannot be reported without qualification.

3.2 Method Detection Limit. Experimentally determine MDLs using the procedure specified in 40 CFR, Part 136, Appendix B. This value represents the lowest reportable concentration of an individual compound that meets the method qualitative identification criteria.

3.2.1 Experimental MDLs must be determined annually for this method.

3.2.2 Process all raw data for the replicate analysis in each MDL study.

4.0 DEFINITIONS

BATCH: A group of samples which behave similarly with respect to the sampling or the testing procedures being employed and which are processed as a unit. For QC purposes, if the number of samples in a group is greater than 20, then each group of 20 samples or less will all be handled as a separate batch.

CALIBRATION CHECK STANDARD. The calibration check standard is a mid-range calibration standard. The calibration check standard must be run at a frequency of 10 percent or less.
The mid-level calibration check standard criteria is either ± 5 or ± 10 percent of the true value.

EXTERNAL CHECK STANDARD. The external check standard is a standard from a separate source than the calibration curve that is used to verify the accuracy of the calibration standards. An external check must be run a minimum of once per quarter for all analyses where a check is commercially available. The laboratory should initially assess laboratory performance of a check standard using the control limits generated by the external check supplier. In house limits should also be generated once sufficient external check standard data is available to generate limits (usually a minimum of 20 to 30 analyses). If the external check is outside of the control limits for a given parameter, all samples must be reanalyzed for that parameter after the problem has been resolved.
SPIKE BLANK OR LAB CONTROL SAMPLE. Digest and analyze a laboratory control sample or spike blank with each set of samples. A minimum of one lab control sample or spike blank is required for every 20 samples. Assess laboratory performance against the control limits specified in the SOP. In house limits should also be generated once sufficient external check standard data is available to generate limits (usually a minimum of 20 to 30 analyses). If the lab control is outside of the control limits for a parameter, all samples must be redigested or redistilled and reanalyzed for that parameter. The exception is if the lab control recovery is high and the results of the samples to be reported are less than the reporting limit. In that case, the sample results can be reported with no flag.
MATRIX: The component or substrate (e.g., water, soil) which contains the analyte of interest.

MATRIX DUPLICATE: A duplicate sample is digested at a minimum of 1 in 20 samples. The relative percent difference (RPD) between the duplicate and the sample should be assessed. The duplicate RPD is calculated as shown below. Assess laboratory performance against the control limits that are specified in the SOP. In house limits are generated once sufficient duplicate data is available to generate limits (usually a minimum of 20 to 30 analyses). If a duplicate is out of control, flag the results with the appropriate footnote. If the sample and the duplicate are less than 5 times the reporting limits and are within a range of ± the reporting limit, then the duplicate is considered to be in control. Note: If control limits are not specified in the SOP, use default limits of ± 20% RPD.

$$\frac{(|\text{Sample Result} - \text{Duplicate Result}|) \times 100}{(\text{Sample Result} + \text{Duplicate Result})/2} = \text{Duplicate RPD}$$

MATRIX SPIKE: The laboratory must add a known amount of each analyte to a minimum of 1 in 10 samples. The matrix spike recovery is calculated as shown below. Assess laboratory performance against the control limits that are specified in

the SOP. In house limits are generated once sufficient matrix spike data is available to generate limits (usually a minimum of 20 to 30 analyses). If a matrix spike is out of control, then the results should be flagged with the appropriate footnote. If the matrix spike amount is less than one fourth of the sample amount, then the sample cannot be assessed against the control limits and should be footnoted to that effect.

$$\frac{\text{(Spiked Sample Result - Sample Result)}}{\text{(Amount Spiked)}} \times 100 = \text{Matrix Spike Recovery}$$

MATRIX SPIKE DUPLICATES: Intralaboratory split samples spiked with identical concentrations of target analyte(s). The spiking occurs prior to sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.

$$\frac{\text{(|MS Result - MSD Result|) x 100}}{\text{(MS Result + MSD Result)/2}} = \text{MSD RPD}$$

METHOD BLANK. The laboratory must digest and analyze a method blank with each set of samples. A minimum of one method blank is required for every 20 samples. For a running batch, a new method blank is required for each different digestion day. If no digestion step is required, then the method blank is equivalent to the reagent blank. The method blank must contain the parameter of interest at levels of less that the reporting limit for that parameter. If the method blank contains levels over the reporting limits, the samples must be redigested or redistilled and reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the method blank level. In addition, if all the samples are less than a client required limit and the method blank is also less than that limit, then the results can be reported as less than that limit.

METHOD DETECTION LIMITS (MDLS). The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. MDLs should be determined approximately once per year for frequently analyzed parameters.

REAGENT BLANK: The reagent blank is a blank that has the same matrix as the samples, i.e., all added reagents, but did not go through sample preparation procedures. The reagent blank is an indicator for contamination introduced during the analytical procedure. (Note: for methods requiring no preparation step, the reagent blank is equivalent to the method blank.) Either a reagent blank or a method blank must be analyzed with each batch of 20 samples or less. The concentration of the analyte of interest in the reagent blank must be less than the reporting limit for that analyte. If the reagent blank contains levels over the reporting limits, the samples must be reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the reagent blank level. In addition, if all the samples are less than a client required limit and the reagent blank is also less than that limit, then the results can be reported as less than that limit.

REAGENT GRADE: Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

REAGENT WATER: Water that has been generated by any method which would achieve the performance specifications for ASTM Type II water. For organic analyses, see the definition of organic-free reagent water.

REFERENCE MATERIAL: A material containing known quantities of target analytes in solution or in a homogeneous matrix. It is used to document the bias of the analytical process.

STANDARD CURVE: A plot of concentrations of known analyte standards versus the instrument response to the analyte. Calibration standards are prepared by successively diluting a standard solution to produce working standards which cover the working range of the instrument. Standards should be prepared at the frequency specified in the appropriate section. The calibration standards should be prepared using the same type of acid or solvent and at the same concentration as will result in the samples following sample preparation. This is applicable to organic and inorganic chemical analyses.

5.0 HEALTH & SAFETY

5.1 The analyst must follow normal safety procedures as outlined in the Accutest Laboratory Safety Manual which includes the use of safety glasses and lab coats. In addition, all acids are corrosive and must be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical must be treated as a potential health hazard. Exposure to these reagents should be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets must be made available to all personnel involved in these analyses.

5.3 After the mercury digestate is reduced to Hg vapor, it must be handled in a closed system or in a hood to prevent inhalation of the toxic vapor. Make sure that the Hg instrument is vented directly to a hood.

6.0 PRESERVATION AND HOLDING TIME

6.1 All water samples must be preserved by acidification with nitric acid to a pH of 2 or lower and stored in a polyethylene or glass container.

6.2 All samples must be analyzed within 28 days of the date of collection.

7.0 INTERFERENCES

7.1 Possible interference from sulfide is eliminated by the addition of potassium permanganate. Concentrations of sulfide as sodium sulfide as high as 20 mg/l do not interfere with mercury recoveries when following this method. High copper concentrations (> 10 mg/l) may also interfere with mercury recoveries.

7.2 Samples that are high in chloride such as seawater, brine, and industrial effluent may require as much as 25 ml of additional permanganate. NOTE: When chloride concentrations are high, hydroxylamine sulfate and stannous sulfate should be used in place of the corresponding chlorides.

7.3 Finally, certain volatile organic materials will also absorb at this wavelength and can interfere. It can be determined if this type of interference is present by doing a preliminary run without reagents.

8.0 APPARATUS

8.1 Two Leeman instruments are available for analysis. One is a Leeman Hydra II AA automated analyzer and the other is a Leeman Hydra AA automated analyzer. Refer to the instrument manuals for further details on this instrumentation, including proper venting and safety requirements. Instrument maintenance is outlined below.

8.1.1 Change the sample tubing as needed.

8.1.2 Change the drying tubing as needed.

8.1.3 Clean the exterior of the instrument as needed.

8.1.4 Adjust the Hg lamp as needed. This can be done in the software on both instruments.

8.1.5 Complete any other maintenance required to maintain the instrument in good running order including, but not limited to, cleaning the cell, changing other tubing, changing the Hg lamp, etc.

8.2 Heating Equipment.

8.2.1 Graphite heating block. Capable of heating at 95 °C for 2 hours.

8.3 Digestion Bottles. Disposable plastic digestion tubes are used with the graphite heating block.

8.3.1 Disposable plastic digestion tubes (65 ml volume) with tops for graphite heating block.

8.4 Calibrated glass tubes with verified 60.0 ml and 100.0 ml final volume calibration mark for bringing graphite heating block digestates to their final volume. (The 100 ml calibration is only required for soil digestions).

8.4.1 At a minimum of once per year, the calibration of these bottles must be verified and documented in the Hg Bottle calibration log following the procedure outlined below.

8.4.2 Carefully measure 60.0 ml of room temperature (20 to 25 deg. C) deionized water with a class A to deliver volumetric cylinder and pour into the calibrated Hg bottle.

8.4.3 If the bottom of the meniscus is on the calibration line, then the bottle passes calibration and can be used.

8.4.4 If the bottom of the meniscus is not on the line, then the bottle should be removed from service and replaced with a newly calibrated bottle. New bottles are calibrated following the same procedure as above, except that a line must be etched into the bottle at the bottom of the meniscus of the 60 ml of DI water.

8.4.4.1 Two different lines for the same volume (i.e. 60 ml) cannot be etched on the same bottle as that may lead to confusion in the measurement of the final volume.

8.4.5 Repeat the steps in 8.4.2 through 8.4.4 using a 100 ml final volume instead of the 60 ml final volume.

8.5 Class A, to deliver, volumetric cylinders for measuring initial sample volumes and for calibrating glass tubes as outlined above.

8.6 Automatic pipettor bottles. Refer to EQA063 for calibration information.

9.0 REAGENTS

All chemicals listed below are reagent grade unless otherwise specified. Deionized water should be used whenever water is required. All solutions listed below may be scaled up or down proportionally as needed.

9.1 Sulfuric acid, concentrated.

9.2 Nitric acid, concentrated. This acid must have a low mercury content.

9.3 Dilution acid. To approximately 400 ml of DI water, add 33.4 ml of concentrated sulfuric and 16.6 ml of concentrated nitric. Dilute to a final volume of 1000 ml. This dilution acid is used for making dilutions of digested samples.

9.4 Stannous chloride. Add 7.5 ml of concentrated sulfuric acid to approximately 400 ml of DI water. Dilute to 500 ml with DI water and mix well. Add 50 g of stannous chloride and dissolve. Make sure that this solution is dissolved while in use.
9.4.1 Stannous sulfate may be used in place of stannous chloride.

9.5 Sodium chloride-Hydroxylamine hydrochloride. Add 240 g of sodium chloride and 240 g of hydroxylamine hydrochloride to 2000 ml of water. Mix well. Hydroxylamine sulfate may be used in place of hydroxylamine hydrochloride.

9.6 Potassium Permanganate, 5 percent solution, w/v. Add 50 g of potassium permanganate to 1000 ml of water and mix well. **Caution** - Potassium permanganate is a strong oxidizing agent. Handle with care.

9.7 Potassium Persulfate, 5 percent solution, w/v. Dissolve 50.0 g of potassium

persulfate in 1000 ml of water and mix well. Caution - Potassium persulfate is a strong oxidizing agent. Handle with care.

9.8 Mercury standard solutions.

9.8.1 10 ppm Hg solution. Using a 1.00 ml volumetric pipet or autopipet, add 1.00 ml of 1000 ppm stock (to be purchased from a vendor such as Fisher) to a 100 ml volumetric flask containing approximately 75 ml of water and 2.0 ml of concentrated nitric acid. Dilute to volume with water and mix well. This standard may be held for up to 28 days.

9.8.1.1 The 10 ppm external source should be made up following the directions in 9.8.1.

9.8.2 40.0 ppb Hg solution. Using an autopipet, add 0.400 ml of 10 ppm Hg solution to a 100 ml volumetric flask containing approximately 75 ml of water and 2.0 ml of concentrated nitric acid. Dilute to volume with deionized water and mix well. This standard must be made fresh daily.

9.8.2.1 The 40.0 ppb external source should be made up following the directions in 9.8.2.

9.8.3 4 ppb Hg solution. Using volumetric pipets or autopipets, add 10.0 ml of 40.0 ppb Hg solution to a 100 ml volumetric flask containing approximately 75 ml of DI water and 2.0 ml of concentrated nitric acid. Dilute to volume with deionized water and mix well. This standard must be made fresh daily.

10.0 WATER DIGESTION FOR GRAPHITE HEATING BLOCK

Below is a step-by-step procedure for the digestion and analysis of water samples for mercury.

10.1 If necessary, acid rinse disposable digestion tubes with 10% nitric acid and deionized water before use.

10.2 Make up a standard curve consisting of 5 standards and a blank. Suggested concentrations are shown below. All standards are made up to a final volume of 40 ml. Different concentrations may also be used, as long as all of the method requirements are met. Make sure to clearly label each bottle. Calibration standards must be prepared fresh with each digestion batch.

ml of 4 ppb Hg solution	ml of 40 ppb Hg solution	Ml of DI water	Total ug of Hg	ug/L of Hg
0.000	0.000	40	0.000	0.000
2.00	0.000	38.0	0.008	0.20
5.00	0.000	35.0	0.020	0.50
0.00	1.00	39.0	0.040	1.00
0.00	2.50	37.5	0.100	2.50
0.00	5.00	35.0	0.200	5.00

10.3 Samples. For each sample, homogenize the sample well and measure out a representative 40.0 ml aliquot of the sample into the digestion tube using a class A, to deliver, graduated cylinder. A smaller volume may be used if there are matrix problems or high levels of mercury in the sample.

10.4 Make up additional quality control samples as shown below, using a final volume of 40 ml for each check standard. (Note: if a different standard curve is run, then the levels of the CCV and ICV standards should be adjusted accordingly in accordance with the requirements in the methods) Make sure to clearly label each bottle. Make sure to prepare enough CCV checks for the entire run. The ICV check must be from an alternate source of standards than the calibration curve. The CCV must be made from the same source as the calibration curve. A low check standard at the level of the CRDL (0.20 ug/l) is also required. This 0.20 ug/l check can be made up as outlined for the standard curve.

Sample ID	ml of 40 ppb Hg solution	ml of DI water	Total ug of Hg
CCV Check(s)	2.5	37.5	0.25
MB	0.0	40	0.0
MS	2.0	(a)	0.20 (b)
MSD	2.0	(a)	0.20 (b)
ICV	3.0	37.0	0.30
LCS	2.0	38.0	0.20

a (a) 40 ml of sample
(b) plus the level of Hg in the sample.

10.5 To all samples, QC, and standards add the reagents listed below, swirling the samples well after each addition of reagent. Allow the samples to stand for at least 15 minutes after the addition of the permanganate. If the sample decolorizes, add additional permanganate until the purple color persists.

- 2.0 ml of conc. sulfuric acid.
- 1.0 ml of conc. nitric acid.
- 6.0 ml of 5% permanganate solution.

Wait 15 minutes, then

- 3.2 ml of potassium persulfate solution.

10.5.1 All of the additions shown can be done with a bottle pipettor which must be accurate to within a range of 90 to 110%.

10.6 Cap the samples and place them in the graphite heating block and heat for 2 hours at 95 °C. Record the digestion times and temperature.

10.7 Enter the prep data into the LIMS system, double checking all volumes and spike amounts. After the prep data is checked, it can be approved and is available for use in the final calculations.

11.0 COLD VAPOR ANALYSIS PROCEDURE HYDRA AA

11.1 While the samples are digesting, begin setting up the Leeman analyzer following the steps outlined below. Additional instructions are available in the instrument operators' manual.

11.1.1 Turn on the nitrogen and adjust to 60 to 90 psi. Turn on the instrument power if it is not already on.

11.1.2 Check the pump tubing and make sure that it is not flattened. Change if appropriate. Put the tubing in the clamps on the pump. Check the drying line and make sure that it is clean. Put fresh stannous chloride solution in the stannous chloride bottle. Fill the rinse bath or rinse bottle with fresh 10% nitric acid. The bath should be filled no more than ¾ full. Place the autosampler line and the stannous chloride line in the rinse container.

11.1.3 Turn on the analyzer and allow it to warm up.

11.1.3.1 In the software, go to the Runner section and select the control tab. Click on the Hg lamp and the pump. The gas will turn on automatically when the pump is turned off. If can also be turned on separately if necessary. The pump rates and gas pressure are set in the protocol. Refer to the instrument maintenance manual for more information on setting up a new protocol. If the Hg lamp needs to be optimized, it can be done using the lab adjust on this page.

11.1.4 Tighten the pump clamps until the flow is coming evenly through the lines. Do not overtighten.

11.1.4.1 In the software, go to the Utility tab and pick the gas control test option. The output should be approximately 7 psi and the input should be between 60 to 90 psi. If the pressures are not correct, check with the area supervisor or manager before proceeding.

11.1.5 Start a batch to save your data.

11.1.5.1 Go to the sample runner tab and click on start new batch. The batch name is limited to 8 characters. The batch should normally be named H1 or H2 followed by the month and date, followed by the matrix designation for the batch, following by the run number. For example, the first water batch on instrument 2 for 3/24/03 would be named H20324w1. The realtime print option can also be turned on from this tab.

11.1.6 Set up autosampler racks containing the samples that are going to be run.

11.1.6.1 Go to main tab and click on the rack editor button. Enter your samples and the appropriate QC. CCV and CCB checks can be entered in the macro column. This tab may also be reached by

clicking on the autosampler icon at the top of the page.

11.1.7 Set up the calibration.

11.1.7.1 Enter or verify the standard values. From the runner menu click on the standard tab. Click the buttons to the left of the standards that are to be run. Also click on the number of replicates to be run for each standard. Normally one replicate is run per standard. The standard concentrations are defined under the database menu under the line info tab. The check standard concentrations and acceptance ranges are also defined under this line info tab. Make sure to always click apply when any changes are made in a tab.

11.2 Add hydroxylamine hydrochloride to all samples and standards as outlined below.

11.2.1 Add 2.4 ml of hydroxylamine hydrochloride solution to each standard and sample and swirl until the solution has been completely decolorized. Transfer to a calibrated glass cylinder and dilute to a final volume of 60 ml and swirl to mix.

11.2.2 They hydroxylamine hydrochloride can be added using a bottle pipettor which is accurate in a range of 90 to 110%.

11.3 Measure out aliquots of the digested standards and samples into the autosampler cups. Work from the prep log and double check all transfers. Let all samples sit uncovered in the open autosampler vials for a minimum of one minute. Place the racks in the autosampler. Move the stannous chloride line into the stannous chloride bottle.

11.4 Start the calibration.

11.4.1 Turn on the real time report by checking the real time printing option on the runner menu either under main or under sample. Then go to the runner menu and the standard tab. Push the standard auto button. The calibration curve will be run by the autosampler. When the curve is complete, go to the database menu and click the calibration curve tab. Check to make sure that all acceptance criteria are met and then accept the curve. See section 13.3 for calibration curve criteria. Make sure that the curve is printed as soon as it is accepted.

11.5 After the calibration has been accepted, start to run the samples.

11.5.1 Go to the runner menu and the sample tab. Pick the autosampler rack that is to be run and type in the start cup and the end cup. Then push the button for run auto.

11.6 Review the data. Any samples that are over the range of the curve should be diluted with the dilution acid (see Section 9.3) and reanalyzed. It is recommended that any sample analyzed after a sample with a value over the curve be reanalyzed for confirmation. Make sure to bracket every 10 samples with CCV and CCB checks.

11.7 Both paper and electronic reports can be generated using the report option. Never delete any samples from the reports. Electronic reports should be transferred into the LIMS system where the final calculations are done.

11.7.1 Go to the data base menu and pick the report tab. Make sure that the correct report specification has been chosen (normally Accutest). Pick the batch that is to be printed and then push the generate report button. Generate both the electronic reports (prn file) and printed reports (report) from this menu.

11.8 The calculations are done in the LIMS as described below. A final volume of 40.0 ml is used for calculation purposes for graphite heating block digestions. (The volume of 60.0 ml is factored out since all standards and samples are brought up to the same final volume and standard concentrations are calculated based on 40.0 ml.)

Final sample concentration in mg/L =

$$\frac{\text{concentration in the digestate in ug/l x final volume in ml}}{\text{initial volume in ml}}$$

11.9 Review the data in the LIMS, adding comments and accepting results as appropriate.

11.10 Shut down the instruments.

11.10.1 To shut down the Hydra AA instrument, move the stannous chloride line from the stannous chloride bottle to the rinse container. Let the system rinse with 10% nitric for several minutes. Then switch the bath to DI water and let rinse for several more minutes. Then empty the rinse bath and let the pump and gas run until the lines are completely dry. Go to Taskmaster and select the standby mode option. Release the tension on all of the pump clamps.

12.0 COLD VAPOR ANALYSIS PROCEDURE HYDRA AA II

12.1 While the samples are digesting, begin setting up the Leeman analyzer following the steps outlined below. Additional instructions are available in the instrument operators' manual.

12.1.1 Turn on the nitrogen and adjust to 60 to 90 psi. Turn on the instrument power if it is not already on.

12.1.2 Check the pump tubing and make sure that it is not flattened. Change if appropriate. Put the tubing in the clamps on the pump. Check the drying line and make sure that it is clean. Put fresh stannous chloride solution in the stannous chloride bottle. Fill the rinse bath or rinse bottle with fresh 10% nitric acid. The bath should be filled no more than ¾ full. Place the autosampler line and the stannous chloride line in the rinse container.

12.1.3 Turn on the analyzer and allow it to warm up.

12.1.3.1 For the Hydra AA II, open the Envoy software. Go to Method and click Instrument Control. On the Instrument Control page, click the startup icon. This will turn on the lamp, gas, and pump. You may also turn on/off the lamp, gas and pump individually on the Instrument Control Page.

12.1.4 Tighten the pump clamps until the flow is coming evenly through the lines. Do not overtighten.

12.1.4.1 Go to the Instrument control tab and pick the gas control test option. The input should be approximately 0.25 LPM. If the pressures are not correct, check with the area supervisor or manager before proceeding.

12.1.5 Start a batch to save your data.

12.1.5.1 Create a new chapter (Data File) by clicking Analysis. The batch should normally be named H5 followed by the month date and year, followed by the matrix designation for the batch, following by the run number. For example, the first water batch on instrument for 3/24/03 would be named H5032411w1. The realtime print option can also be turned on from this tab.

12.1.6 Set up autosampler racks containing the samples that are going to be run.

12.1.6.1 Create a new sequence by clicking sequence-new. Type the sequence name. After typing the samples in to sequence page make sure to click update and save. CCV and CCB checks can be entered in the macro column of the sequence page.

12.1.7 Set up the calibration.

12.1.7.1 Go to the Method menu, enter or verify the standard concentration by clicking on the standard tab. Also select number of replicates to be run for each standard. Normally one replicate is run per standard. The check standard concentrations and acceptance ranges are also defined under this standard info tab. Make sure to always click apply when any changes are made in a tab.

12.2 Add hydroxylamine hydrochloride to all samples and standards as outlined below.

12.2.1 Add 2.4 ml of hydroxylamine hydrochloride solution to each standard and sample and swirl until the solution has been completely decolorized. Transfer to a calibrated glass cylinder and dilute to a final volume of 60 ml and swirl to mix.

12.2.2 They hydroxylamine hydrochloride can be added using a bottle pipettor which is accurate in a range of 90 to 110%.

12.3 Measure out aliquots of the digested standards and samples into the autosampler cups. Work from the prep log and double check all transfers. Let all samples sit uncovered in the open autosampler vials for a minimum of one minute. Place the racks in the autosampler. Move the stannous chloride line into the stannous chloride bottle.

12.4 Start the calibration.

12.4.1 Click run sequence. The instrument will run the calibration and then pause. Click stop. Go to the Calibration page. Accept the calibration and then print the calibration. Click the Document icon, then choose HG5-PDF. Rename the file as MA*****_cal.

12.5 After the calibration has been accepted, start to run the samples.

12.5.1 For the Hydra AA II, go to the Sequence page. Right click on the first sample (ie. ICV) and click start from here.

12.6 Review the data. Any samples that are over the range of the curve should be diluted with the dilution acid (see Section 9.3) and reanalyzed. It is recommended that any sample analyzed after a sample with a value over the curve be reanalyzed for confirmation. Make sure to bracket every 10 samples with CCV and CCB checks.

12.7 Both paper and electronic reports can be generated using the report option. Never delete any samples from the reports. Electronic reports should be transferred into the LIMS system where the final calculations are done.

12.7.1 Go to analysis-Click result-Click chapter. Then go to report and select report spec. The normal report spec is "ACCUTEST". Click OK. Click on chapter in order to select all samples. Then click report output and then csv.file. Save as MA*****.csv. To print, select printer output and then type the report title (i.e. MA*****) and enter OK.

12.8 The calculations are done in the LIMS as described below. A final volume of 40.0 ml is used for calculation purposes for graphite heating block digestions. (The volume of 60.0 ml is factored out since all standards and samples are brought up to the same final volume and standard concentrations are calculated based on 40.0 ml.)

Final sample concentration in mg/L =

$$\frac{\text{concentration in the digestate in ug/l x final volume in ml}}{\text{initial volume in ml}}$$

12.9 Review the data in the LIMS, adding comments and accepting results as appropriate.

12.10 Shut down the instruments.

12.10.2 To shut down the Hydra AA II, move the stannous chloride line from the stannous chloride bottle to the 10% HNO3 rinse bottle. Let the

system rinse with 10% HNO3 for several minutes. Then switch the line to DI water bottle and let rinse for several more minutes. Let the pump and gas run until the lines are completely dry. Then go to instrument control menu and click off icon for Lamp, Gas and Pump.

13.0 QUALITY CONTROL

Below is a summary of the quality control requirements for this method. Make sure to check with the laboratory supervisor or manager for any additional client specific quality control requirements.

13.1 Instrument Detection Limits (IDLs). The instrument detection limits must be done a minimum of once per year or when instrument conditions change significantly. The IDL is generated by running 10 replicates of a digested blank. The IDL is then defined as 3 times the standard deviation of the 10 replicates of the blank.

13.2 Method Detection Limits (MDLs). MDLs should be established using a solution spiked at approximately 3 times the estimated detection limit. To determine the MDL values, take seven replicate aliquots of the spiked sample and process through the entire analytical method. The MDL is calculated by multiplying the standard deviation of the replicate analyses by 3.143, which is the student's t value for a 99% confidence level. MDLs should be determined approximately once per year or whenever there is a significant change in the background or instrument response.

13.3 Instrument Calibration. The instrument must be calibrated daily or at a minimum of once every 24 hours and each time the instrument is set up. Calibration standards should be prepared fresh with each preparation batch. A minimum of a blank and 5 standards are required. The correlation coefficient of the curve must be a minimum of 0.995. No samples should be analyzed until all of the calibration criteria are met. Resloping is acceptable as long as it is immediately preceded and immediately followed by a complaint CCV and CCB.

13.4 Linear Dynamic Range (LDR). For each instrument, the upper limit of the linear dynamic range must be established. A linear calibration should be prepared from 3 standards, one of which is close to the upper limit of the linear range. The LDR is determined by analyzing succeedingly higher standard concentrations of mercury until the observed analyte concentration is no more than 10 percent below the true value of the standard. Sample concentrations that are greater than 90% of the determined upper LDR limit must be analyzed using dilutions. The LDR should be verified annually or whenever there is a significant change in the instruments analytical performance.

13.5 Quality Control Sample (also referred to as Initial Calibration Verification Standard (ICV)). At a minimum of once per quarter, a standard from a different source than the calibration standard must be analyzed. Normally this is analyzed at the beginning of the run after the CCV and CCB checks. The ICV must be within 10 percent of the true value. It is recommended that this standard be analyzed with each run so that it is included with all client reports. For SW846 7470A, this standard should be at a concentration near the

midpoint of the calibration curve. If the ICV is outside of the acceptance limits, then the problem must be corrected and the ICV reanalyzed and shown to be within QC limits before any samples can be reported. All reported samples must be bracketed by an ICV which meets acceptance criteria.

13.5.1 If the ICV is biased high and all sample results are < RL, then, at the discretion of the data reviewer, data may be reported.

13.6 Method Blank. The laboratory must digest and analyze a method blank with each set of samples. A minimum of one method blank is required for every 20 samples. For a running batch, a new method blank is required for each different digestion day. The method blank must contain mercury at less that the reporting limit. If the method blank contains over that limit, the samples must be redigested or reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the method blank level. In addition, if all the samples are less than a client required limit and the method blank is also less than that limit, then the results can be reported as less than that limit.

13.7 Lab Control Sample. The laboratory must digest and analyze a laboratory control sample (spike blank) with each set of samples. A minimum of one lab control sample is required for every 20 samples. For a running batch, a new lab control sample is required for each different digestion day. For method 245.1, the laboratory must assess laboratory performance of an aqueous lab control against recovery limits of 85 to 115 percent. For method 7470A, the laboratory must assess laboratory performance of an aqueous lab control against recovery limits of 80 to 120 percent. In either case, if the lab control recovery is high and the results of the samples to be reported are less than the reporting limit, then the sample results can be reported with no flag. If the lab control recovery is low or there are samples above the reporting limit, then all affected samples must be redigested and reanalyzed.

13.8 Matrix Spike.

13.8.1 For method 245.1, the laboratory must add a known amount of each analyte to a minimum of 1 in 10 samples. The spike recovery should be within the limits of 70 to 130. If a matrix spike is out of control, then the results should be flagged with the appropriate footnote. If the matrix spike amount is less than one fourth of the sample amount, then the sample cannot be assessed against the control limits and should be footnoted to that effect.

13.8.2 For method 7470A, the laboratory must add a known amount of each analyte to a minimum of 1 in 20 samples. The laboratory should assess the matrix spike recovery against limits of 75 to 125. (In house control limits are also generated on an annual basis and are used to support the default limits.) An exception to this rule occurs where the sample concentration exceeds the spike concentration by a factor of 4 or more. If the matrix spike fails this criterion, then the sample should be flagged as showing possible matrix interferences.

13.8.3 Both the matrix spike amount and the sample amount are calculated to the IDL for any given element. Any value less than the IDL is treated

as zero. Refer to the calculation shown below.

$$\frac{\text{(Spiked Sample Result - Sample Result)}}{\text{(Amount Spiked)}} \times 100 = \text{MS Recovery}$$

13.9 Matrix Spike Duplicate or Matrix Duplicate. The laboratory must digest a matrix spike duplicate or a duplicate sample for a minimum of 1 in 20 samples. Matrix spike duplicates are normally used unless otherwise specified by client requirements. The relative percent difference (rpd) between the matrix spike duplicate and the matrix spike or between the duplicate and the sample should be assessed. The calculations for both rpds are shown below.

13.9.1 For method 245.1, the control limits for the matrix spike duplicates or the duplicates are calculated on an annual basis and are used to assess whether a matrix spike duplicate or a duplicate is in control. If it is out of control, then the results should be flagged with the appropriate footnote. If the sample and the duplicate are less than 5 times the reporting limits and are within a range of ± the reporting limit, then the duplicate is considered to be in control.

13.9.2 For method 7470A, the duplicate or matrix spike duplicate RPD must be assessed against a limit of 20% RPD. (In house control limits are also generated on an annual basis and are used to support the default limits.) If it is out of control, then the results should be flagged with the appropriate footnote. If the sample and the duplicate are less than 5 times the reporting limits and are within a range of ± the reporting limit, then the duplicate is considered to be in control.

13.9.3 Both the duplicate amount and the sample amount are calculated to the IDL for any given element. Any value less than the IDL is treated as zero. Refer to the calculations shown below.

$$\frac{\text{(Sample Result - Duplicate Result)} \times 100}{\text{(Sample Result + Duplicate Result)} \times 0.5} = \text{\% RPD}$$

or

$$\frac{\text{(MS Result - MSD Result)} \times 100}{\text{(MS Result + MSD Result)/2}} = \text{MSD RPD}$$

13.10 Continuing Calibration Verification. (Also known as the instrument performance check solution.) The CCV must be from the same source as the calibration curve.

13.10.1 Analyze the continuing calibration verification solution and the continuing calibration blank after every tenth sample and at the end of the sample run. If the CCV solution is not within a method specified range of the true value, then no samples can be reported in the area bracketed by that CCV. (Note: the exception is if the CCV is biased high and the samples are less than the detection limit. In that case, the samples can be reported with no flag.) The CCV concentration

should be at or near the mid-range of the calibration curve.

13.10.1.1 For method 245.1, the CCV must be within 10 percent of the true value.

13.10.1.2 For method 7470A, the CCV must be within 20 percent of the true value.

32.10.2 The ICCV check must also be analyzed at the beginning of the run, immediately after the instrument is calibrated. For method 245.1, this first check must be within 5 percent of the true value. If it is not and there is not a problem with the standard solution, the instrument should be recalibrated and rechecked.

13.10.2.1 This check is not required for method SW846 7470A.

13.11 Continuing Calibration Blank. Analyze the continuing calibration verification solution and the continuing calibration blank after every tenth sample and at the end of the sample run. If the CCB is not less than the reporting limit, then no samples can be reported in the area bracketed by the failing CCB.

13.12 CRA (Low) Check. For all runs, a low check at the level of the CRDL (0.20 ug/l) or reporting limit must be analyzed at the beginning of the run before analyzing any samples, but not before the ICV. No specific acceptance criteria are listed in any of the methods for this standard at this time. An in-house criterion of 50 to 150% recovery is applied to this low check standard. If this criterion is not met, then all samples associated with this CRA check must be reanalyzed along with a compliant CRA check.

13.12.1 If the CRA is biased high and there is no mercury found in the samples, then the sample results may be reported for mercury. If the CRA is biased high and there is mercury found in the samples, then the samples with Hg at levels ranging from the CCV to the high standard may be reported. Samples with levels of mercury between the CRA and the CCV standard may be biased high and cannot be reported.

13.12.2 Some client may require additional bracketing low checks to be analyzed. Client specific limits may also be required. Check with the area supervisor or manager for more information.

14.0 DOCUMENTATION REQUIREMENTS

Refer to the laboratory Quality Assurance Manual for additional documentation requirements.

14.1 Sample Worksheets. Digestion data sheets for the Hg water samples must show all digestion information including the sample ID's, sample volumes, bottle numbers, start times, end times, and pressure or temperature, as appropriate for all digestions. The digestion method (i.e digestion block) must be indicated on the digestion sheet. All sample information should be clearly entered on these sheets. In addition, any unusual characteristics of the

samples or the digestion procedure should be noted in the Comments sections. Make sure also that all dilutions are clearly documented.

14.2 Standards and Reagents. All stocks and reagents must be recorded in the reagent logbook. All standards should be recorded on the digestion log with the samples.

14.3 Any run comments should be written on the raw data for the analysis and on the run log in the LIMS.

14.4 Annual bottle calibration verifications must be documented in the Mercury Bottle calibration log.

15.0 DATA REVIEW AND REPORTING

15.1 All samples should be updated to QC batches in the LIMS system. The analyst is responsible for reviewing all data for compliance with the QC outlined in this SOP. They are responsible for making sure that the raw data is fully documented and it is loaded into the LIMS system. They are responsible for submitting samples for redigestion and reanalysis, when appropriate.

15.2 After the analyst review is completed, the supervisor or a designated reviewer shall review the run for technical compliance to the SOP. The reviewer is also responsible for making sure that the QC calculations are done correctly and that appropriate flags are added.

15.3 After the reviewer completes their review, the data is released for client access in the LIMS. The raw data and the run log are submitted to the area manager. The manager periodically does an additional review on data for technical completeness. Any hardcopy raw data is transferred to the report generation department for scanning and storage. Instrument data is transferred electronically.

16.0 POLLUTION PREVENTION & WASTE MANAGEMENT

16.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 16.2.

16.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, EHS 004. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:

16.2.1 Non hazardous aqueous wastes.

16.2.2 Hazardous aqueous wastes.

16.2.3 Chlorinated organic solvents.

16.2.4 Non-chlorinated organic solvents.

16.2.5 Hazardous solid wastes.

16.2.6 Non hazardous aqueous wastes.

17.0 ADDITIONAL REFERENCES

17.1 Leeman Hydra II AA instrument manual.

17.2 Leeman Hydra AA Instrument manual.

Lab Manager Harvey Cole

QA Manager Jerry Parker for Phil Worby

Effective Date: 9/12/11

TEST NAME: METALS BY INDUCTIVELY COUPLED PLASMA ATOMIC EMISSION SPECTROMETRY (ICP) USING SOLID STATE ICP.

METHOD REF: SW846 6010C

Revised Sections: ***1.2, Tables 1, 2, 3, 4, and 5***

1.0 SCOPE AND APPLICATION

1.1 This method is applicable for the determination of metals in water, wipes, sludges, sediments, and soils. Sample matrices are pretreated following SW846 methods for digestion of soil, sediment, sludge, wipe or water samples. Refer to specific digestion SOP's for more information on digestion techniques.

1.2 A variety of metals can be analyzed by ICAP. These include, but are not limited to, Al, Sb, As, Ba, Be, B, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, K, S, Se, Sl, Ag, Na, Sr, Tl, Sn, Ti, Pd, V, W, Zn, and Zr.

2.0 SUMMARY

2.1 Prior to analysis, samples must be solubilized or digested using appropriate Sample Preparation Methods. When analyzing groundwater samples for dissolved constituents, acid digestion is not necessary if the samples are filtered and acid preserved prior to analysis.

2.2 This SOP describes operation of the ICAP 6500 Spectrometer following method SW846 6010C.

2.2.1 This inductively coupled argon plasma optical emission spectrometers (ICP-OES) uses an Echelle optical design and a Charge Injection Device (CID) solid-state detector to provide elemental analysis. Control of the spectrometer is provided by PC based iTEVA software.

2.2.2 In the instrument, samples are nebulized and the resulting aerosol is transported to the plasma torch. Element-specific emission spectra are produced by a radio-frequency inductively coupled plasma. The spectra are dispersed by a spectrometer, and the intensities of the emission lines are monitored the solid state detector.

2.2.3 Background correction is required for trace element determination. Background must be measured adjacent to analyte lines on samples during analysis. The position selected for the background-intensity measurement, on either or both sides of the analytical line, will be determined by the complexity of the spectrum adjacent to the analyte line. In one mode of analysis the position used should be as free as possible from spectral interference and should reflect the same change in

background intensity as occurs at the analyte wavelength measured. Background correction is not required in cases of line broadening where a background correction measurement would actually degrade the analytical result. Interferences which cannot be addressed with background correction must be corrected using the appropriate interelement correction factors.

3.0 REPORTING LIMIT AND METHOD DETECTION LIMIT

3.1 Reporting Limit. The normal reporting limits for this method have been established at the concentrations listed in Table 1. Reporting limits may vary depending on client needs and lab protocols, but the reporting limits must always be verified with a low check which meets the criteria outlined in this SOP. In addition, the reporting limits must always be greater than the MDL. Refer to the scheduling sheets and check with the metals supervisor for further information.

3.2 Method Detection Limit. Experimentally determine MDLs using the procedure specified in 40 CFR, Part 136, Appendix B. This value represents the lowest reportable concentration of an individual compound that meets the method qualitative identification criteria.

3.2.1 Experimental MDLs must be determined annually for this method.

4.0 DEFINITIONS

BATCH: A group of samples which behave similarly with respect to the sampling or the testing procedures being employed and which are processed as a unit. For QC purposes, if the number of samples in a group is greater than 20, then each group of 20 samples or less will all be handled as a separate batch.

CALIBRATION CHECK STANDARD. The calibration check standard is a mid-range calibration standard. It is recommended that the calibration check standard be run at a frequency of approximately 10 percent during an analysis run, whichever is more frequent, and at the end of the analysis sequence. For this method, the mid-level calibration check standard criteria is ± 10 percent of the true value and the relative standard deviation for the replicates that are greater than 5 times the reporting limit is less than 5 percent. The exception to this rule is if the recovery on the calibration check standard is high and the samples to be reported are less than the reporting limit.

EXTERNAL CHECK STANDARD. The external check standard is a standard from a separate source than the calibration curve that is used to verify the accuracy of the calibration standards. An external check must be run with each calibration. For this method, the external check standard criteria is ± 10 percent of the true value and the replicates that are greater than 5 times the reporting limit should have a relative standard deviation of less than 5 percent. If the external check is outside of the control limits for a given parameter, all samples must be reanalyzed for that parameter after the problem has been resolved.

SPIKE BLANK OR LAB CONTROL SAMPLE. Digest and analyze a laboratory control sample or spike blank with each set of samples. A minimum of one lab control sample or spike blank is required for every 20 samples. For a running batch, a new lab control sample or spike blank is required for each different digestion day. Assess laboratory performance against the control limits of 80 to 120 percent. In house limits should also be generated once sufficient data (usually a minimum of 20 to 30 analyses) is available to support the default limits. For solid lab controls, the elements should be within the range given by the lab control supplier. If the lab control or spike

blank is outside of the control limits for a parameter, all samples must be redigested and reanalyzed for that parameter. The exception is if the lab control or spike blank recovery is high and the results of the samples to be reported are less than the reporting limit. In that case, the sample results can be reported with no flag.

MATRIX: The component or substrate (e.g., water, soil) which contains the analyte of interest.

MATRIX SPIKE DUPLICATE: A matrix spike duplicate sample is digested at a minimum of 1 in 20 samples. The relative percent difference (RPD) between the matrix spike duplicate and the matrix spike should be assessed. A duplicate may be used in place of the matrix spike duplicate on client request. The matrix spike duplicate RPD is calculated as shown below. The control limit for the duplicate is 20% rpd. If a duplicate is out of control, flag the results with the appropriate footnote. If the sample and the duplicate are less than 5 times the reporting limits and are within a range of ± the reporting limit, then the duplicate is considered to be in control.

$$\frac{(\text{Matrix Spike Result} - \text{Matrix SpikeDuplicate Result}) \times 100}{(\text{Matrix Spike Result} + \text{Matrix Spike Duplicate Result})/2} = \text{Duplicate RPD}$$

MATRIX SPIKE: The laboratory must add a known amount of each analyte to a minimum of 1 in 20 samples. The matrix spike recovery is calculated as shown below. Assess laboratory performance against the default limits of 75 to 125 percent. If a matrix spike is out of control, then the results should be flagged with the appropriate footnote. If the matrix spike amount is less than one fourth of the sample amount, then the sample cannot be assessed against the control limits and should be footnoted to that effect.

$$\frac{(\text{Spiked Sample Result} - \text{Sample Result})}{(\text{Amount Spiked})} \times 100 = \text{Matrix Spike Recovery}$$

METHOD BLANK. The laboratory must digest and analyze a method blank with each set of samples. A minimum of one method blank is required for every 20 samples. For a running batch, a new method blank is required for each different digestion day. If no digestion step is required, then the method blank is equivalent to the reagent blank. The method blank must contain the parameter of interest at levels of less than ½ of the reporting limit for that parameter. If the method blank contains levels over this level, then the samples must be redigested and reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the method blank level. In addition, if all the samples are less than a client required limit and the method blank is also less than that limit, then the results can be reported as less than that limit.

METHOD DETECTION LIMITS (MDLS). The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. MDLs should be determined approximately once per year for frequently analyzed parameters.

REAGENT BLANK: The reagent blank is a blank that has the same matrix as the samples, i.e., all added reagents, but did not go through sample preparation procedures. The reagent blank is an indicator for contamination introduced during the analytical procedure. (Note: for methods requiring no preparation step, the reagent blank is equivalent to the method blank.) Either a reagent blank or a method blank must be analyzed with each batch of 20 samples or less. The concentration of the analyte of interest in the reagent blank must be less than the reporting limit for that analyte. If the reagent blank contains levels over the reporting limits, the samples must be reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the reagent

blank level. In addition, if all the samples are less than a client required limit and the reagent blank is also less than that limit, then the results can be reported as less than that limit.

REAGENT GRADE: Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

REAGENT WATER: Water that has been generated by any method which would achieve the performance specifications for ASTM Type II water.

STANDARD CURVE: A plot of concentrations of known analyte standards versus the instrument response to the analyte. Calibration standards are prepared by successively diluting a standard solution to produce working standards which cover the working range of the instrument. Standards should be prepared at the frequency specified in the appropriate section. The calibration standards should be prepared using the same type of acid or solvent and at the same concentration as will result in the samples following sample preparation. This is applicable to organic and inorganic chemical analysis.

LOW LEVEL CALIBRATION VERIFICATION (CRI or LLCCV). The LLCCV or CRI standard is a check standard containing the elements of interest at (or below) the reporting level for each element. For this method, the CRI (LLCV) must be analyzed at the beginning and end of each calibration (analysis) batch. The acceptance criterion for the CRI check is 70 to 130% recovery. If an element does not meet this criterion, then all bracketed samples for that element in the concentration range between the CRI and the CCV must be reanalyzed. Samples containing concentrations higher than the CCV may be reported as long as CCV criteria are met.

5.0 HEALTH & SAFETY

5.1 The analyst must follow normal safety procedures as outlined in the Accutest Health and Safety Plan and Personal Protection Policy, which include the use of safety glasses and lab coats. In addition, all acids are corrosive and must be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical must be treated as a potential health hazard. Exposure to these reagents must be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets must be made available to all personnel involved in these analyses.

6.0 PRESERVATION & HOLDING TIME

6.1 All water samples should be preserved with nitric acid to a pH of 2 or less. All solid samples should be stored in a refrigerator at 4 degrees C.

6.2 All samples should be analyzed within 6 months of the date of collection.

7.0 INTERFERENCES

7.1 Several types of interferences can cause inaccuracies in trace metals determinations by ICP. These interferences are discussed below.

7.2 Spectral interferences are caused by overlap of a spectral line from another element, unresolved overlap of molecular band spectra, background contribution from continuous or recombination phenomena, and background contribution from stray light from the line emission of high concentration elements. Corrections for these interferences can be made by using interfering element corrections, by choosing an alternate analytical line, and/or by applying background correction points.

7.3 Physical interferences can be caused by changes in sample viscosity or surface tension, by high acid content in a sample, or by high dissolved solids in a sample. These interferences can be reduced by using an internal standard, by making sample dilutions or by analyzing a sample using the method of standard additions.

7.4 Chemical interferences are not pronounced with ICAP due to the high temperature of the plasma, however if they are present, they can be reduced by optimizing the analytical conditions (i.e. power level, torch height, etc.).

8.0 EQUIPMENT AND SUPPLIES

8.1 Currently there are two solid state ICPs available for use in the lab. Both are Thermo 6500 ICP units. These units have been optimized to obtain low detection limits for a wide range of elements. Since they are solid state systems, different lines may be included for elements to obtain the best analytical results. However, the lines which are normally included in the normal analysis program are shown in Table 2.

8.2 Instrument autosamplers. For random access during sample analysis.

8.3 Class A volumetric glassware and pipets.

8.3.1 All glassware must be washed with soap and tap water and then soaked in a 10% nitric acid bath for a minimum of 2 hours. It must then be rinsed at least 3 times with deionized water.

8.4 Glass autosampler tubes

8.4.1 Autosampler tubes must be washed with soap and tap water and then soaked in a 10% nitric acid bath for a minimum of 2 hours. They must then be rinsed at least 3 times with deionized water.

8.5 Autopipeters with tips. These must be calibrated and checked as outlined in the autopipeter SOP, EQA004.

9.0 REAGENTS

9.1 All chemicals listed below are reagent grade unless otherwise specified. Deionized water must be used whenever water is required. The expiration date for standards and reagents is the date supplied by the manufacturer or if no expiration date is given, a default of 6 months is used. For

acid solutions (nitric, sulfuric, hydrochloric) the expiration date is 2 years from the date of preparation of the solution.

9.2 Hydrochloric acid, trace metals grade.

9.3 Nitric Acid, Baker instra-analyzed or equivalent.

9.4 Standard stock solutions available from Absolute, Inorganic Ventures, MV Laboratories, Ultra Scientific or equivalent. Note: All standards must be ICP quality standards.

9.5 Calibration Standards. These can be made up by diluting the stock solutions to the appropriate concentrations . It is recommended that fresh calibration standards should be prepared a minimum of every two weeks. They must be monitored on a daily basis by comparison to an ICV. Standards which are going to be stored for several days should be transferred to FEP fluorocarbon or previously unused polyethylene or polypropylene bottles for long term storage.

9.5.1 Standards should be approximately matrix matched to the samples. For most samples, a 5 percent nitric acid and 5 percent hydrochloric acid will approximate the acid matrix of the sample and limit nebulization problems. If it is known that the samples contain a significantly different acid matrix, then the matrix of the standards should be modified or the samples should be diluted so that they are in a similar matrix to the curve.

9.5.2 Standards should be prepared so that there is minimal spectral interference between analytes.

9.5.3 Refer to the standards book for the make-up and concentrations of standards and stock solutions being used to calibrate the ICP. The standard curve consists of a blank and 3 non-zero standards at the levels shown in Table 3.

9.6 Calibration/Rinse Blank. The calibration blank is prepared by diluting a mixture of 50 ml of concentrated nitric acid and 50 ml of concentrated hydrochloric acid to a final volume of 1 liter with deionized water.

9.7 Analytical Quality Control Solutions. All of the solutions below are prepared by adding either mixed or single element metals solutions to a solution containing 5 percent nitric acid and 5 percent hydrochloric acid and diluting to a fixed final volume with this acid mixture. All of these solutions should be placed in FEP fluorocarbon or previously unused polyethylene or polypropylene bottles for long term storage.

9.7.1 Initial Calibration Verification solution. This standard solution must be made from a different source than the calibration curve. The values for each element should be near the midpoint of the calibration curve. This solution is used to verify the accuracy of the initial calibration. See Table 4 for suggested ICV concentrations.

9.7.2 Continuing Calibration Verification solution. The metals concentrations for this standard should be at approximately the mid-point of the calibration curve for each element. This standard should be prepared from the same source that is used for the calibration curve. See Table 4 for suggested CCV concentrations.

9.7.3 Interference Element Check Solutions. These solutions should be used on a periodic basis to check the interfering element corrections on the instruments. Note: If interferences from different elements than those listed below are a problem, the interfering element solutions may be modified. Two acceptable solutions are outlined below.

9.7.3.1 ICSA Solution. The ICSA solution contains only the interfering elements. The recommended concentrations are shown below. If the linear ranges on a given instrument are lower than these levels, the concentrations may be set near the top of the linear range for those elements.

Al	500 mg/L
Ca	400 mg/L
Fe	200 mg/L
Mg	500 mg/L

9.7.3.2 ICSAB Solution. The ICSAB solution contains both the interferents and the analytes of interest. The recommended concentrations are shown below. If the linear ranges on a given instrument are lower than these levels, the concentrations may be set near the top of the linear range for those elements

Ag	1.0 mg/L	Zn	1.0 mg/L
Ba	0.50 mg/L	As	1.0 mg/L
Be	0.50 mg/L	Se	1.0 mg/L
Cd	1.0 mg/L	Sb	1.0 mg/L
Co	0.50 mg/L	Tl	1.0 mg/L
Cr	0.50 mg/L	Mo	0.5 mg/L
Cu	0.50 mg/L	Pd	0.5 mg/L
Mn	0.50 mg/L	Al	500 mg/L
Ni	1.0 mg/L	Ca	400 mg/L
Pb	1.0 mg/L	Fe	200 mg/L
V	0.50 mg/L	Mg	500 mg/L
W	0.50 mg/L	Zr	0.50 mg/L

9.7.4 CRI Standards (also referred to as LLCCV). The CRI standard must contain the elements of interest at (or below) the reporting limit for each element. The CRI level is at the reporting limit as shown in Table 1. This should be prepared by diluting calibration standard(s) to the reporting limit level for each element. They should be made in the same matrix as the calibration standards. Note: The CRI must be verified at the RL before any dilutions are applied

9.8 Matrix Spike and Spike Blank Solution (For soil samples). The final concentrations suggested for the matrix spike and spike blank solutions are shown in Table 5. The spiking solution is prepared by adding either mixed or single element metals solutions to a solution containing 2 percent nitric acid and diluting to a fixed final volume with this acid mixture. Two mls of this stock solution should be added to the spike blank and the matrix spike before they are digested and brought to a final volume of 100 ml.

9.9 Matrix Spike and Lab Control Solution (For aqueous samples and TCLP leachates).

9.9.1 The final concentrations suggested for the matrix spike are shown in Table 5. Two spiking solutions, which are used for aqueous samples and TCLP leachates respectively, are prepared by adding either mixed or single element metals solution to solutions containing 2 percent nitric acid and diluting to a fixed final volume with this acid mixture. 0.5 ml of the resulting stock solution is added to the matrix spike sample before they are digested.

9.9.2 A lab control sample should be digested and analyzed for every batch of 20 samples or less. The LCS is prepared by adding either mixed or single element metals solutions to DI water and bringing up to a fixed final volume. For TCLP samples, the lab control should be made using blank leachate solution rather than DI water. 50 ml of this solution is digested and brought to a final volume of 50 ml. In situations where any odd elements, such as B, Si, Sr, Sn, and Pd, is of interest for a specific project, besides a lab control, a spike blank is also digested.

9.10 Liquid Argon or Argon Gas. Argon is provided by Air Products in the large outdoor tank. No lab monitoring of the tank is normally necessary

9.11 Internal Standard Solution (with matrix modifier). To a 1 liter flask containing approximately 800 ml of DI water, add 10.0 ml of 10,000 mg/l Lithium solution, 5.0 ml of 10000 mg/l indium, and 1.000 ml of 10000 mg/l yttrium. Add 50 ml concentrated nitric acid and 50 ml concentrated hydrochloric acid and bring to a final volume of 1000 ml and mix well. This solution is added to all samples and standards as the instrument is running using a split line on the peristallic pump

10.0 PROCEDURE

10.1 General procedure on how to operate the SS Trace1 is described below. Refer to the Thermo 6500 operation manual for further details.

10.2 Before bringing up the instrument, make sure that the lines, the torch, the nebulizer, and the spray chamber are clean, the dehumidifier is filled with DI water up to the level between Minimum and Maximum, and that there are no leaks in the torch area.

10.3 Turn on the recirculating cooler. Verify that the liquid argon is turned on.

10.4 Set up the pump tubing and engage the peristaltic pump.

10.5 Put a new solution of acid rinse into the rinse reservoir. (Note: the composition of the rinse solution may be periodically changed to minimize sample introduction problems and sample carryover.) If internal standard is being used, make sure that sufficient internal standard solution is prepared.

10.6 Start up the instrument following the sequence shown below.

10.6.1 Double click the **iTEVA Control Center** Icon on desktop. Type ***admin*** in User Name field, and then click OK.

10.6.2 Once the iTEVA Control Center window is opened, click on **Plasma** Icon at status bar area. Then click on **Instrument Status** to check the interlock indicators (torch compartment, purge gas supply, plasma gas supply, water flow and exhaust should

be in green; drain flow and busy should be in gray) and the Optics Temperature. (It should be around 38°C.) Click on the Close box.

10.6.3 Click **Plasma On**. When the plasma is on, click close. Let the instrument warm up for 15 to 20 minutes before starting the analysis. New tubing may take an hour to stabilize .

10.7 Torch Alignment and Auto Peak

10.7.1 If the torch has been cleaned, then it has to be realligned after it is replaced

10.7.1.1 Open the method and then click on **Sequence** tab, then click on List View Icon until you reach rack display.

10.7.1.2 Go to S-6 position (you can assign any position in the rack for torch alignment), then right click to select Go to empty sample S:6. (Now, the autosampler tip moves from Rinse to this position)

10.7.1.3 Click on **Analysis** tab, then select **Torch Alignment** from **Instrument** drop down menu. There will be a pop up dialog box present. Click RUN. Then there will be another dialog box pop up (This is a reminder for Torch Alignment Solution (2 ppm Zn)), click Ok. Now, the instrument is initiating an automated torch alignment. It takes about 7 minutes to complete this step. Progress is indicated in the progress bar.

10.7.1.4 After Torch Alignment is done, click Close. Click on **Sequence** tab, then follow by **List View** Icon.

10.7.1.5 Go to Rinse position at rack display, right click to select Go to rinse and let it rinse for 2 minutes.

10.7.2 Perform Auto Peak.

10.7.2.1 It is recommended that the Auto Peak Adjust procedure be performed monthly or whenever the peak shape has shifted for any element. A standard that contains all of the lines of interest is used and the system automatically makes the appropriate fine adjustment. (CCV solution is used for this process.)

10.7.2.2 Click **Sequence** tab, then click on **List View** Icon till the rack is displayed.

10.7.2.3 Go to S-5 position (you can assign any position in the rack for auto peak adjust), then right click to select Go to empty sample S:5. (Now, the autosampler tip moves from Rinse to this position). Click on **Analysis** tab. All elements' result is showed in the display area. From **Instrument** drop down menu, select **Perform Auto Peak**. There will be a pop up dialog box present. Highlight _All Elements_, then click RUN. Then there will be another dialog box pop up (This is a reminder for Perform Auto Peak Solution), click Ok. Now, the instrument is performing auto peak adjust. It takes about 5 minutes to complete this process. The Auto Peak dialog box will show a green " √" in front of All Elements, which indicates Auto Peak is completed.

10.8 Open the method and start up the run.

10.8.1 Click on **Analyst** Icon at the workspace. Go the Method and choose Open from the drop down menu. Select the method with a Revision (usually select the last revision used).

10.8.2 Go to **Method** tab at the bottom of left-hand corner to click on **Automated Output** at the workspace area. Type a filename in Filename field in the data display area (i.e.: SA073107M1: starts with SA, then follow by MM-DD, then M1; M1 indicates the first analytical run for that day, then follow by M2, M3 and so on for the second and third runs).

10.8.3 Click on **Sequence** tab at the bottom of left-hand corner. From **Auto-Session** drop down menu bar, click on **New Autosampler** to create a sequence. This will pop up a dialog box , then click on **New** and fill number of samples (i.e.: 100) in the Number of Samples field and the sample ID (usually leave this field empty) in Sample Name field. Type a sequence name (i.e.: SEQ073107M1: starts with SEQ, then MM-DD-YY, then M1; M1 indicates the first analytical run for that day, then follow by M2, M3 and so on for the second and third runs) in the Sequence Name field. Click OK, then put in "0" on Settle Time Between Sequences box, click OK.

10.8.4 Right click on **Untitled** (CETAC ASX-520 Enviro 5 Named Rack is the rack that currently using) at the workspace area, click on **Auto-Locate ALL** to locate all samples.

10.8.5 Double click on **Untitled** again, then click on the sequence name (i.e.: SEQ073107M1), on the data display area, type the sequence in Samplename column, dilution factor (if needed) in CorrFact column, check the box in front of Check column, and select an appropriate check table.

10.8.6 Once done with creating sequence, go to **Method** drop down menu and save all changes as **Save As**. There will be a Save a Method dialog box present, go to Save Option to check on "Overwrite Method and bump revision number" box, then click OK.

10.8.7 Go to **Sequence** tab, click on **List View** Icon from tool bar, then click on **Connect Autosampler to PC and Initialize** Icon. (Now, the autosampler tip is up and sits on the top of the rinse cup.)

10.8.8 The sequence includes the calibration and run quality control.

10.8.8.1 Calibrate the instrument as outlined below using the standards shown in Table 3. This calibration procedure is done a minimum of once every 24 hours. The calibration standards may be included in the autosampler program or they may be run separately. A correlation coefficient of 0.998 or better must be obtained using a first order curve fit. Second and third order curve fits are not acceptable.

10.8.8.2 Run the CRI (LLCCV) solution after the calibration is completed and before any samples are analyzed.

10.8.8.2.1 For all samples, the CRI check solution must be at the reporting limit for each element. If special client reporting limits are requested, then low checks corresponding to those reporting limits must also be analyzed.

10.8.8.2.2 Method limits of 70 to 130% are applied to the CRI standard, but tighter criteria may be needed in some client or project specific situations.

10.8.8.3 Then continue by analyzing the ICV check standard followed by the CCV, CCB, ICSA, ICSAB, and CCV, CCB every 10 samples. (An ICB may be run following the ICV, but is not required.) For mixed runs (EPA 200.7 and SW846 6010C), the first CCV is designated the ICCV. For samples and quality control, insert the list pointer after a space after the sample. Check with the metals supervisors for additional information on the use of listpointers. In general, listpointer 2 refers to the SW846 6010 method and listpointer 1 refers to EPA 200.7 method.

10.8.8.3.1 For the ICV, all elements to be reported must be within 10 percent of the true values. After the ICV (and ICB, if run) and before any actual samples are analyzed, the CCV and CCB must be analyzed. For the CCV, all elements to be reported must be within 10 percent of the true values. For both ICV and CCV, all replicates exceed 5 times the reporting limit should have a relative standard deviation of less than 5 percent. Both ICB and CCB results should be less than the reporting limits for the every element.

10.8.8.4 Before analyzing any real samples, an interference check solution must be checked. For all spiked elements, the analyzed results must be within 20 percent of the true results. For unspiked elements, the interfering element solutions should contain less than two times the absolute value of the reporting limit for each element.

10.8.8.5 If the interfering element solution is not within specifications and that element must be reported, then new interfering element correction (IEC) factors will need to be generated following the procedure outlined in Section 11 below. If new IEC's are generated, then the run must be restarted from the ICSA, ICSAB quality control samples and new CCV checks must be run before any samples can be reported.

10.8.8.6 After the initial analytical quality control has been analyzed, the samples and the preparation batch quality control should be analyzed. Each sample analysis should be a minimum of 2 readings using at least a 5 second integration time. For samples containing levels of elements greater than approximately 5 times the reporting limits, the relative standard deviations for the replicates should be less than 5%. If not, reanalyze the sample. If, upon reanalysis, the RSDs are acceptable, then report the data from the reanalysis. If RSD's are not acceptable on reanalysis, then the results for that element should be evaluated by the data reviewer and footnoted if

necessary. In some cases, an additional dilution analysis may be needed. Check with the area supervisor or manager for additional information.

10.8.8.7 Between each sample, flush the nebulizer and solution uptake system with a blank rinse solution for the required period of time to ensure that analyte memory effects are not occurring. A time of 120 seconds is recommended for most analyses with the current autosampler set-up.

10.8.8.8 Analyze the continuing calibration verification solution and the continuing calibration blank after every tenth samples during an analysis run, whichever is more frequent, and at the end of the sample run.

10.8.8.9 If the CCV solution is not within 10 percent of the true value, no samples can be reported in the area bracketed by the failing CCV for the falling element. Additionally, for the elements with a CCV greater than 5 times the reporting limit, the relative standard deviation for the replicates should be less than 5 percent.

10.8.8.10 The CCB results must be less than the reporting limit or limit of quantitation for each desired target analyte. If this criterion is not met, then no samples can be reported in the area bracketed by the failing CCB for the failing element and all samples should be submitted for reanalysis.

10.8.8.10.1 However, if the samples are high relative to the CCB (> 10 X the CCB level) and a higher reporting limit is acceptable for the final end use of the data, then the samples may be evaluated using a higher reporting limit to meet the CCB criteria. This must be clearly documented on the run if a higher reporting limit is applied.

10.8.8.10.2 In addition, at the reviewer's discretion, samples that are < RL may be reported when the CCB is biased high. Analysts should assume that samples bracketed by a failing CCB must be reanalyzed unless instructed otherwise.

10.8.8.10.3 If a CCB fails, if possible, the analyst should stop the run and run a new CCV, CCB pair before proceeding with the analysis of any additional samples.

10.8.8.11 For one sample per preparation batch, or whenever matrix interferences are suspected for a batch of samples, a serial dilution should be prepared. Normally the sample used for the serial dilution is the sample that is used for the matrix spike and matrix spike duplicate. For the serial dilution, a 1:5 dilution must be made on the sample. The results of the 1:5 dilution should agree within 10 percent of the true value as long as the sample is greater than 50 times the reporting limit for that element before dilution (or 10 times the reporting limit after dilution) and the sample results are within the linear range. If not, an interference effect must be suspected and the serial dilution result for the element with the suspected interference must be footnoted. The serial dilution is calculated as shown below

10.8.8.12 If the matrix spike or matrix spike duplicate is out of acceptable limits, then it is recommended that post-digest spikes be prepared to determine potential interferences. For the post-spike, the sample should be spiked with approximately 2 times the sample level or two times the reporting limits, whichever is greater. Limits of 80 to 120 percent are applied. The serial dilution is used to confirm any matrix effects. The post-digest spike recovery must be footnoted on the matrix spike recovery or otherwise noted in the quality control summary report.

10.8.8.13 For any readings that exceed the linear range for a given element, a dilution is required. After a high reading, the sample following the high one must be examined for possible carryover. A verification may be necessary by rinsing the lines with an acid solution and then rereading the sample. A limit check table may be built into the autosampler file so that samples exceeding the linear range are flagged on the raw data.

10.8.8.14 For the interelement spectral interference corrections to remain valid during sample analysis, the interferent concentration must not exceed its linear range. If the interferent exceeds its linear range or its correction factor is big enough to affect the element of interest even at a lower concentration, sample dilution with reagent blank and reanalysis is required. In these circumstance analyte detection limits are raised. Check with metals supervisor for more information.

10.8.8.15 Anytime that the interference is large relative to the sample, dilution may be required. Check with the metals supervisor for more information.

10.8.8.16 For any readings where the internal standard is outside of the range of 70 to 130% of the internal standard level in the calibration blank, then the sample should be diluted until the internal standard is within that range.

10.8.9 The CRI (LLCCV) must be analyzed at the end of each calibration (analysis) batch. The acceptance criterion for the CRI check is 70 to 130% recovery. If an element does not meet this criterion, then all samples for that element in the concentration range between the CRI and the CCV must be reanalyzed. Samples containing concentrations higher than the CCV may be reported as long as CCV criteria are met. Multiple levels of CRI checks may be analyzed if different reporting limits are being applied to samples on the run.

10.8.9.1 More frequent CRI (LCCV) checks may be analyzed during the course of the run if system stability at the low end of the calibration is questionable or if the lab wants to ensure that fewer samples will have to be submitted for reanalysis if there is a failed CRI at the end of a run.

10.8.9.2 It is recommended that the CRI check be run bracketing every 4 to 8 hour period of analysis. It may be run as frequently as every 10 samples if the supervisory staff deems that this is necessary.

10.8.10 This method does not require the analysis of an interfering element check solution at the end of the run. However, this may be required to meet other method and/or client requirements. Run the ICSA and ICSAB solutions every 8 hours unless otherwise

instructed by the metals lab supervisor or manager. Note: The decision can also be made that the 8 hour ICSA/ICSAB was not required at the time of review. Because the 8 hour ICSA/ICSAB is a project specific requirement, the data reviewer can accept data where the ICSA/ICSAB was not run every 8 hours for any project that does not carry the specific 8 hour requirement.

10.8.11 After the instrument is optimized, click **Run Auto-Session** Icon to start the run.

10.8.12 If you need to add or delete samples once the run is started, follow the steps shown below.

10.8.12.1 Adding Samples.

10.8.12.1.1 Click on **Sequence** tab, then click on **List View** Icon at the tool bar. There is the sequence table on the data display area.

10.8.12.1.2 Click on **Add Samples** Icon. This will pop up the dialog box, then fill number of samples that need to add in field. Click OK. By doing this, samples will be added at the end of sequence without a location the rack.

10.8.12.1.3 Go to the added samples, on the to position ID column, assign a number for each sample. This number will be the position in the rack. On the Samplename column, type in sample IDs, fill in Corr Fact (if needed) and Check Table.

10.8.12.1.4 The added samples will be analyzed at the end of the original sequence run order unless you assign them to run under different order.

10.8.12.2 Deleting Samples.

10.8.12.2.1 Click on **Sequence** tab, then click on **List View** Icon under the sequence display area.

10.8.12.2.2 To the sample that need to be deleted, on the to position ID column, change the number to "0". By doing this, that sample will be unlocated in the rack and the autosampler tip will go to the next sample.

10.9 When the analysis is completed export the data to LIMS following the procedure outlined below.

10.9.1 Double click on **ePrint** Icon on desktop. There will be a LEADTOOLS ePRINT dialog box pop up, then click **Finish Jobs** and **OK** boxes.

10.9.2 Double click the **PDF** Icon on desktop, the PDF file will present as Document_#. Right click on that file, select **Rename** to change the file name to an assigned analytical run ID. (i.e.: MA8324). This is the raw data for MA8324.

10.9.3 Drop the raw data to Lims.

10.9.4 By completing above steps, the raw data (i.e: MA8324) can be pulled up in the Raw Data Search function.

10.10 The data must be reviewed in the LIMS as outlined in the inorganic data review SOP, EQA034. Calculations for water samples are done automatically in the LIMS using the equation shown below.

original sample concentration of metal (µg/l) =

$$\frac{\text{(conc. in the digestate (µg/l)) x (final digestate volume (ml))}}{\text{(Initial sample volume (ml))}}$$

10.11 Aft the end of the analysis day, the ICP must be brought down using the following sequence:

10.11.1 Place the autosampler tip in rinse cup and rinse in a mixed solution of 5% nitric acid and 5% hydrochloric acid for 10 minutes and in DI water for 20 minutes. **Note:** A stronger acid may be needed depending on the matrix of the samples that were analyzed.

10.11.2 Turn off the plasma by click on the **Plasma** Icon and click on **Plasma Off**.

10.11.3 Close all iTEVA programs/ windows.

10.11.4 Release the tension on the sample pump platen.

10.11.5 Switch off recirculating chiller.

11.0 PROCEDURE FOR GENERATION OF INTERFERING ELEMENT CORRECTION FACTORS

11.1 All IEC's must be verified and updated a minimum of once every 6 months or whenever instrument conditions change significantly. It is recommended that elements with frequent high concentrations or with large IEC's should be checked more frequently.

11.2 Calculate the IEC correction factors and enter them into the method. Verify that the recalculated sample results are within QC limits. Calculate the correction factor using the equation shown below. This correction factor must be added to the correction factor already in place in the method for a given element.

$$\text{IEC} = \frac{\text{Concentration Result of the element with the interference}}{\text{Concentration result of the interfering element}}$$

11.3 Analyze the ICSA/ICSAB solutions and/or SIE solutions and verify that the combined standards are within QC limits. If they are not, make additional changes to the IEC factors and then re-verify both the individual and combined solution values.

11.4 Save and update the method.

11.5 Interfering element correction factors saved as raw data along with the run printouts on a daily basis so that the IEC's for a given run are traceable.

12.0 QC REQUIREMENTS

12.1 This section outlines the minimum QA/QC operations necessary to satisfy the analytical requirements for method SW846 6010C.

12.2 Method Detection Limits (MDLs). MDLs should be established for all analytes, using a solution spiked at approximately 3 to 5 times the estimated detection limit. To determine the MDL values, take seven replicate aliquots of the spiked sample and process through the entire analytical method. The MDL is calculated by multiplying the standard deviation of the replicate analyses by 3.14, which is the student's t value for a 99% confidence level. MDLs should be determined approximately once per year or whenever there is a significant change in the background or instrument response.

12.3 Instrument Detection Limits (IDLs). Instrument Dection Limits (IDLs). It is required that IDL's be completed a minimum of every 3 months for all analytes or whenever instrument conditions have significantly changed. The Instrument Detection Limits (in ug/L) are determined by analyzing 7 replicates of a reagent blank solution on 3 non-consecutive days. The IDL is defined as 3 times the average of the standard deviations of the 3 days. For the IDL, each measurement shall be performed as though it were a separate analytical sample (i.e., each measurement shall be followed by a rinse and/or any other procedure normally performed between the analysis of separate samples). IDLs shall be determined and reported for each wavelength used in the analysis of the samples.

12.4 Linear Calibration ranges. The upper limit of the linear calibration ranges should be established for each analyte by determining the signal responses from a minimum of three concentration standards, one of which is close to the upper limit of the linear range. The linear calibration range which may be used for the analysis of samples should be judged by the analyst from the resulting data. Linear calibration ranges should be determined whenever there is a significant change in instrument response and every six months for those analytes that periodically approach their linear limit.

12.4.1 For work following the Army Corp of Engineers Shell document, the linear range cannot exceed the level of the high calibration standard on that run. All elements to be reported that exceed the high standard must be reanalyzed on dilution and the results reported from the dilution.

12.5 Initial Calibration Verification (ICV) and Initial Calibration Blank (ICB). After every new calibration, an ICV must be analyzed. The analysis of the ICV may be followed by the analysis of the ICB, although this is not required by the method.

12.5.1 For the ICV, all elements to be reported must be within 10 percent of the true value and the replicates that exceed 5 times the reporting limit should have a relative standard deviation of less than 5 percent. The ICV must be from a different source than the calibration standards and must be near the mid-point of the calibration curve. If the ICV does not meet criteria, then the problem must be identified and corrected before samples can be run and reported for the element(s) that are outside of criteria. Correction of the problem can be verified by rerunning the check standard and showing that it meets QC criteria.

12.5.2 If an ICB is analyzed, than all elements to be reported must be less than the RL (LLOQ). If the ICB is outside of criteria, then the problem must be identified and

corrected before samples can be run and reported for the element(s) that are outside of criteria. Correction of the problem can be verified by rerunning the check standard and showing that it meets QC criteria. Analysis of a CCB before running any reportable samples can be used to verify that the system meets calibration blank requirements.

12.6 Continuing Calibration Verification (CCV) and Continuing Calibration Blank (CCB). Analyze the continuing calibration verification solution and the continuing calibration blank after every tenth sample and at the end of the sample run.

12.6.1 For the CCV, all elements to be reported must be within 10 percent of the true value and the replicates that are greater than 5 times the reporting limit should have a relative standard deviation of less than 5 percent. The CCV should be made from the same source as the calibration standards at a concentration near the mid-level of the calibration curve. If an element does not meet the recovery criteria of the CCV (90 to 110%), than no samples can be reported for that element in the area bracketed by the CCV.

12.6.1.1 If the replicate rsd is high, but all replicates are within the recovery limits, then the results can be accepted at the discretion of the reviewer.

12.6.2 For the CCB, all elements to be reported must be less than the reporting limit (LLOQ). If an element does not meet this criteria, then no samples can be reported for that element in the area bracketed by the CCB.

12.7 Interference Check Standard. An interference check standard must be analyzed at the beginning of each analytical run. For all spiked elements, the analyzed results must be within 20 percent of the true values. For unspiked elements, the interfering element solutions should contain less than the absolute value of two times the reporting limit for each element. If this criteria is not met, then no samples containing the elements in question can be reported in the area bracketed by this QC unless the samples contain no significant interferents. This method does not require the analysis of an interfering element check solution at the end of the run. However, this may be required due to meet other method and/or client requirements. Run the ICSA and ICSAB solutions every 8 hours unless otherwise instructed by the metals lab supervisor or manager. Note: The decision can also be made that the 8 hour ICSA/ICSAB was not required at the time of review. Because the 8 hour ICSA/ICSAB is a project specific requirement, the data reviewer can accept data where the ICSA/ICSAB was not run every 8 hours for any project that does not carry the specific 8 hour requirement.

12.8 Low Level Calibration Verification (CRI or LLCCV). The CRI standard containing the elements of interest at (or below) the reporting level for each element. The CRI (LLCV) must be analyzed at the beginning and end of each calibration (analysis) batch. The acceptance criterion for the CRI check is 70 to 130% recovery. If an element does not meet this criterion, then all bracketed samples for that element in the concentration range between the CRI and the CCV must be reanalyzed. Samples containing concentrations higher than the CCV may be reported as long as CCV criteria are met.

12.8.1 More frequent CRI (LCCV) checks may be analyzed during the course of the run if system stability at the low end of the calibration is questionable or if the lab

wants to ensure that fewer samples will have to be submitted for reanalysis if there is a failed CRI at the end of a run.

12.8.2 It is recommended that the CRI check be run bracketing every 4 to 8 hour period of analysis. It may be run as frequently as every 10 samples if the supervisory staff deems that this is necessary.

12.9 Method Blank. The laboratory must digest and analyze a method blank with each set of samples. A minimum of one method blank is required for every 20 sample batch. If the method blank does not contain target analytes at a level that interferes with the project-specific DQOs, then the method blank is considered acceptable.

12.9.1 The default SOP limit for the method blank is that is must be less than one half of the reporting limit.

12.9.2 In addition, the blank is considered acceptable if it is less than 10% of the regulatory limit, or less than 10% of the lowest sample concentration for each analyte in a given preparation batch, whichever is greater.

12.9.3 If the method blank does not meet criteria, then it can be reanalyzed along with any associated samples. If it is still unacceptable, then all associated samples must be redigested and reanalyzed along with the other appropriate batch QC samples

12.10 Lab Control Sample or Spike Blank. The laboratory must digest and analyze a laboratory control sample or spike blank with each set of samples. A minimum of one lab control sample or spike blank is required for every 20 sample batch. The laboratory should assess laboratory performance of the lab control and spike blank against recovery limits of 80 to 120 percent. In house lab control and spike blank limits may also be generated to support these default limits. If the lab control or spike blank is outside of the control limits for a given element, all samples must be redigested and reanalyzed for that element.

12.10.1 If solid lab controls are used, then the manufacturer's limits should be applied.

12.11 Matrix Spike. The laboratory must add a known amount of each analyte to a minimum of 1 in 20 samples. The matrix spike recovery is calculated as shown below. Recoveries should be assessed against default limits of 75 to 125 percent. In house limits may be generated for this method for informational purposes only. If a matrix spike is out of control, then the results should be flagged with the appropriate footnote and it is recommended that a post-digest spike be analyzed for the out of control element(s). If the matrix spike amount is less than one fourth of the sample amount, then the sample cannot be assessed against the control limits and should be footnoted to that effect. Note: Both the matrix spike amount and the sample amount are calculated to the IDL for any given element. Any value less than the IDL is treated as zero.

((Spiked Sample Result - Sample Result) / Amount Spiked) x 100 = matrix spike recovery

12.11.1 If a post-digest spike is required, the sample should be spiked with approximately 2 times the sample level or two times the reporting limits, whichever is greater. Limits of 80 to 120 percent are applied. The serial dilution is used to confirm any matrix effects. The post-digest spike recovery must be footnoted on the

matrix spike recovery or otherwise noted in the quality control summary report. If the post-spike recoveries are out of the range of 80 to 120%, then the matrix spike results should be footnoted with a comment that the post-digest spike recovery indicates possible matrix interference.

12.12 Matrix Spike Duplicate (MSD) or Matrix duplicate (DUP). The laboratory must digest a matrix spike duplicate or matrix duplicate sample for a minimum of 1 in 20 samples. The relative percent difference (rpd) between the MSD and the MS or between the DUP and the sample should be assessed. The rpd is calculated as shown below. The control limit for the duplicate rpd is method defined as 20%. If the sample and the duplicate are less than 5 times the reporting limits and are within a range of ± the reporting limit, then the duplicate is considered to be in control. Note: Both the duplicate amount and the sample amount are calculated to the IDL for any given element. Any value less than the IDL is treated as zero.

12.12.1 If a MSD or duplicate is out of control, then the data should be checked carefully to confirm that the high rpd for a given element is not a result of an analytical problem. If an analytical problem is suspected, the MSD or duplicate must be reanalyzed for confirmation. If the initial and reanalysis are in agreement (within 20%), then the high rpd is a result of preparation or sample issues and further analysis of the initial preparation is not required. If the initial and reanalysis are not in agreement due to an analytical problem, then any affected samples in the associated batch should also be reanalyzed for that element.

12.12.2 If more than 50% of the elements in a sample (that have levels of at least 5 times the reporting limit) have a high RPD, then the MSD or duplicate should be redigested for confirmation, unless the sample matrix is such that the non-homogeneity of the sample is visually apparent. If the results confirm, the results from the original MSD or duplicate should be flagged as indicative of possible sample non-homogeneity. If the results do not confirm, then the whole batch should be digested and reanalyzed.

12.12.3 If 50% or less of the elements in a sample (that have levels of at least 5 times the reporting limit) have a high rpd, then the high rpd(s) should be footnoted as indicating possible sample non-homogeneity unless other problems are suspected. If problems are suspected, the reviewer will initiate redigestion and reanalysis of the batch.

12.12.4 The calculations used to calculate RPD are shown below.

$$\frac{(|\text{MS Result} - \text{MSD Result}|) \times 100}{(\text{MS Result} + \text{MSD Result})/2} = \text{MSD RPD}$$

$$\frac{(|\text{Sample Result} - \text{Duplicate Result}|) \times 100}{(\text{Sample Result} + \text{Duplicate Result})/2} = \text{Duplicate RPD}$$

12.13 Serial Dilution. A serial dilution is required on a frequency of one in 20 samples. For one sample per preparation batch, or whenever matrix interferences are suspected for a batch of samples, a serial dilution should be prepared. Normally the sample used for the serial dilution is the sample that is used for the matrix spike and matrix spike duplicate. For the serial dilution, a 1:5 dilution must be made on the sample. The results of the 1:5 dilution should agree within 10 percent of the true value as long as the sample is greater than 50 times the

reporting limit for that element before dilution (or 10 times the reporting limit after dilution) and the sample results are within the linear range. If not, an interference effect must be suspected and the serial dilution result for the element with the suspected interference must be footnoted. The serial dilution is calculated as shown below.

$$\frac{100 \times ((\text{Sample result} - \text{Serial dilution result}))}{\text{Sample result}} = \text{Serial dilution percent difference}$$

12.14 Post Digestion Spike Addition. Post-digest spikes may also be used to determine potential interferences. Check with the metals supervisor for further information on when a post-digest spike should be performed. Recovery limits of 80 to 120 percent should be used to assess post-digest spikes.

12.15 IEC Correction Factor Generation. All interfering element correction factors (IEC's), must be verified and updated a minimum of once every 6 months or whenever instrument conditions change significantly.

12.16 Lower Limit of Quantitation check sample (LLQC). The LLQC is a sample at the reporting limit that is taken through the entire preparation and analytical process. This standard must be analyzed when reporting limits are initial established and on an as needed basis after that. The LLQC is equivalent to the LOQ (Limit of quantitation) standard which must be analyzed quarterly for the DOD QSM 4.1 program. The limits of quantitation are verified when all analytes in the LLQC sample are detected within 30% of their true value. If the limits cannot be verified at the spiked level, then the quantitation limit must be adjusted to a level where verification is successful.

12.17 Calibration Curve. The calibration curve should be prepared daily using a minimum of a calibration blank and three non-zero standards that bracket the desired sample concentration ranges. The calibration curve must have a correlation coefficient greater than or equal to 0.998 and must be verified with initial low level and mid level calibration verification standards before any samples can be analyzed. If the curve does not meet the correlation coefficient requirements or is not verified as described in section 12.5 or 12.8, then no results can be reported for those elements which did not meet quality control criteria.

13.0 CALCULATIONS

13.1 For water samples, the following calculations should be used. Refer to the QC section for the calculations to be used for the QC samples.

$$\text{original sample concentration of metal } (\mu g/l) = \frac{(\text{conc. in the digestate } (\mu g/l)) \times (\text{final digestate volume (ml)})}{(\text{Initial sample volume (ml)})}$$

13.2 For soil samples, the following calculations should be used.

concentration of the metal in the dry sample (mg/kg) =

$$\frac{\text{(conc. in the digestate (mg/l) x final digestate volume(L))}}{\text{(sample wt. (kg)) x (\% solids/100)}}$$

14.0 DOCUMENTATION REQUIREMENTS

14.1 If any samples or QC checks require reanalysis, a brief explanation of the reason must be documented in the raw data. All instrument data should be exported to the LIMS system and a copy of the run log should be included in the logbook by the instrument.

14.2 The Standard Preparation Logbook must be completed for all standard preparations. All information requested must be completed. The Accutest Lot Number must be cross-referenced on the standard vial.

14.3 The Instrument Maintenance Logbook must be completed when any type of maintenance is performed on the instrument. A copy of any outside maintenance reports should also be kept in the log. In addition to the maintenance, the maintenance log should also contain daily information on such items as the profile intensity. Each instrument has a separate log.

14.4 Any corrections to laboratory data must be done using a single line through the error and a reason for the correction. The initials of the person and date of correction must appear next to the correction.

14.5 Supervisory (or peer) personnel must routinely review (at least once per month) all laboratory logbooks to ensure that information is being recorded properly. Additionally, the maintenance of the logbooks and the accuracy of the recorded information should also be verified during this review.

15.0 INSTRUMENT MAINTENANCE

15.1 Recommended periodic maintenance includes the items outlined below.

15.1.1 Change the pump tubing weekly or as needed.

15.1.2 Clean the filter on the recirculating pump approximately once a month and dust off the power supply vents every one to two weeks.

15.1.3 Clean the radial view quartz surface weekly or more often if needed.

15.1.4 Clean the nebulizer, torch, and injector tube every two to four weeks or more often as needed.

15.1.5 Change the sampler tip as needed (every one to two months).

15.1.6 Clean the recirculating pump lines every 3 months or more often if needed.

15.1.7 Clean the slides on the autosampler with methanol and wipe them with a KimWipe saturated with Teflon spray a minimum of once per day.

16.0 POLLUTION PREVENTION & WASTE MANAGEMENT

16.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 16.2.

16.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, EHS004. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:

16.2.1 Non hazardous aqueous wastes.

16.2.2 Hazardous aqueous wastes

16.2.3 Chlorinated organic solvents

16.2.4 Non-chlorinated organic solvents

16.2.5 Hazardous solid wastes

16.2.6 Non-hazardous solid wastes

17.0 ADDITIONAL REFERENCES

17.1 Refer to other SOP's for ICP analysis (CLP, and EPA 200.7 for both DW and WW).

TABLE 1: NORMAL REPORTING LIMITS BY ELEMENT			
Analyte	**Water & Wipe Reporting Limit (µg/l)**	**Soil Reporting Limit (mg/kg)**	**TCLP Reporting Limit (mg/l)**
Aluminum	200	50	
Antimony	6	2	
Arsenic	3	2	0.50
Barium	200	20	1.0
Beryllium	1	0.2	
Cadmium	3	0.5	0.005
Calcium	5000	500	
Chromium	10	1	0.010
Cobalt	50	5	
Copper	10	2.5	
Iron	100	50	
Lead	3	2	0.50
Magnesium	5000	500	
Manganese	15	1.5	
Nickel	10	4.0	
Potassium	10000	1000	
Selenium	10	2	0.50
Silver	10	0.5	0.010
Sodium	10000	1000	
Thallium	2	1	
Vanadium	50	5	
Zinc	20	2	
Boron	100	10	
Molybdenum	20	1	
Palladium	50	5.0	
Sulfur	50	NA	
Silicon	200	20	
Strontium	10	1	
Tin	10	5	
Titanium	10	1	
Tungsten	50	5	
Zirconium	10	2	

TABLE 2: ANALYTICAL LINES ON THE SSTRACE1 AND SSTRACE2	
Element	Wavelength
Al	396.1
As	189.0
Ca	317.9
Fe	259.9
Mg	279.0
Mn	257.610
Pb	220.3
Se	196.0
Tl	190.8
V	292.4
Ag	328.0
Ba	455.4
Be	313.0
Cd	228.8
Co	228.6
Cr	267.7
Cu	324.7
K	766.4
Na	589.5
Ni	231.6
Sb	206.8
Zn	206.2
B	208.9
Mo	202.0
Pd	340.4
S	182.0
Sr	407.7
Sn	189.9
Ti	334.9
Si	212.4
W	207.9
Zr	339.1

TABLE 3: CALIBRATION STANDARD LEVELS in ug/l				
Element	STD A (Blank)	STD B	STD C	STD D
Ba	0	1000	2000	4000
Be	0	1000	2000	4000
Cd	0	1000	2000	4000
Cr	0	1000	2000	4000
As	0	1000	2000	4000
Se	0	1000	2000	4000
Pb	0	1000	2000	4000
Tl	0	1000	2000	4000
Mn	0	1000	2000	4000
Co	0	1000	2000	4000
Zn	0	1000	2000	4000
Cu	0	1000	2000	4000
Ni	0	1000	2000	4000
Sb	0	1000	2000	4000
Mo	0	1000	2000	4000
B	0	1000	2000	4000
Sn	0	1000	2000	4000
Ti	0	1000	2000	4000
Ag	0	125	250	500
V	0	1000	2000	4000
Sr	0	1000	2000	4000
Si	0	2500	5000	10000
Pd	0	1000	2000	4000
W	0	1000	2000	4000
Zr	0	1000	2000	4000
S	0	1000	2000	4000
Al	0	20000	40000	80000
Ca	0	20000	40000	80000
Fe	0	20000	40000	80000
Mg	0	20000	40000	80000
K	0	20000	40000	80000
Na	0	20000	40000	80000

TABLE 4: ICV, and CCV LEVELS		
Element	ICV Suggested Level in ug/l	CCV Suggested Level in ug/l
Al	40000	40000
As	2000	2000
Ca	40000	40000
Fe	40000	40000
Mg	40000	40000
Mn	2000	2000
Pb	2000	2000
Se	2000	2000
Tl	2000	2000
V	2000	2000
Ag	250	250
Ba	2000	2000
Be	2000	2000
Cd	2000	2000
Co	2000	2000
Cr	2000	2000
Cu	2000	2000
K	40000	40000
Na	40000	40000
Ni	2000	2000
Sb	2000	2000
Zn	2000	2000
B	2000	2000
Mo	2000	2000
Pd	2000	2000
Sr	2000	2000
Sn	2000	2000
Ti	2000	2000
Si	5000	5000
W	2000	2000
Zr	2000	2000
S	2000	2000

TABLE 5: SUGGESTED CONCENTRATIONS OF METALS IN THE MATRIX SPIKE AND SPIKE BLANK			
Element	Soils Final Concentration in mg/kg	Aqueous Final Concentration in µg/l	TCLP Leachates Final Concentration in mg/l
Ag	10	50	0.05
Al	5400	2000	
As	400	2000	2.0
B	100	2000	
Ba	400	2000	10.0
Be	10	50	
Ca	1250	25000	
Cd	10	50	0.05
Co	100	500	
Cr	40	200	0.20
Cu	50	250	
Fe	5200	1000	
K	1250	25000	
Mg	1250	25000	
Mn	100	500	
Mo	100	2000	
Na	1250	25000	
Ni	100	500	
Pb	100	500	2.0
Sb	100	500	
Se	400	2000	2.0
Tl	400	2000	
V	100	500	
Zn	100	500	
S	NA	2000	
Sn	100	2000	
Sr	100	2000	
Ti	100	2000	
Si	200	4000	
Pd	100	2000	
W	100	2000	
Zr	100	2000	

ACCUTEST LABORATORIES
STANDARD OPERATING PROCEDURE

Lab Manager Nancy Cole

QA Manager

Effective Date: _____

TITLE: COLD VAPOR ANALYSIS OF MERCURY FOR SOIL SAMPLES

REFERENCES: SW846 7471B

Revised Sections: *7.1, Section 11 (all), Section 12 (all), 13.7, 14.2, 17.1, 17.2*

1.0 SCOPE AND APPLICATION

1.1 This method can be applied for the analysis of mercury in soils, sediments, bottom deposits, and sludge type materials. The reporting limit for mercury soil samples, based on a 0.6 g sample size, is 0.033 mg/kg.

2.0 SUMMARY

2.1 Cold vapor mercury is a flameless AA procedure based on the absorption of radiation at 253.7 by mercury vapor. Organic mercury compounds are oxidized and the mercury is reduced to the elemental state and aerated from solution in a closed system. The mercury vapor passes through a cell positioned in the light path of an atomic absorption spectrophotometer. Results are quantitated by comparison to a daily calibration curve.

3.0 REPORTING LIMIT AND METHOD DETECTION LIMIT

3.1 Reporting Limit. The reporting limit for this method is established at the lowest concentration standard in the calibration curve. Detected concentrations below this concentration cannot be reported without qualification.

3.2 Method Detection Limit. Experimentally determine MDLs using the procedure specified in 40 CFR, Part 136, Appendix B. This value represents the lowest reportable concentration of an individual compound that meets the method qualitative identification criteria.

3.2.1 Experimental MDLs must be determined annually for this method.

3.2.2 Process all raw data for the replicate analysis in each MDL study.

4.0 DEFINITIONS

BATCH: A group of samples which behave similarly with respect to the sampling or the testing procedures being employed and which are processed as a unit. For QC purposes, if the number of samples in a group is greater than 20, then each group of 20 samples or less will all be handled as a separate batch.

CALIBRATION CHECK STANDARD. The calibration check standard is a mid-range calibration standard. It is recommended that the calibration check standard be run at a frequency of approximately 10 percent. Recovery requirements vary by method. For this method a recovery from

80 to 120% is required. (For some methods this is mandatory and for some it is a recommendation only. Refer to individual method SOP's)

EXTERNAL CHECK STANDARD. The external check standard is a standard from a separate source than the calibration curve that is used to verify the accuracy of the calibration standards. An external check must be run a minimum of once per quarter for all analyses where a check is commercially available. If the external check is outside of the control limits for a given parameter, all samples must be reanalyzed for that parameter after the problem has been resolved.

SPIKE BLANK OR LAB CONTROL SAMPLE. Digest and analyze a laboratory control sample or spike blank with each set of samples. A minimum of one lab control sample or spike blank is required for every 20 samples. Assess laboratory performance against the control limits specified in the SOP. If the lab control is outside of the control limits for a parameter, all samples must be redigested or redistilled and reanalyzed for that parameter. The exception is if the lab control recovery is high and the results of the samples to be reported are less than the reporting limit. In that case, the sample results can be reported with no flag. Note: If control limits are not specified in the SOP, then default limits of 80 to 120 percent should be used.

MATRIX: The component or substrate (e.g., water, soil) which contains the analyte of interest.

MATRIX DUPLICATE: A duplicate sample is digested at a minimum of 1 in 20 samples. The relative percent difference (RPD) between the duplicate and the sample should be assessed. The duplicate RPD is calculated as shown below. Assess laboratory performance against the control limits that are specified in the SOP. In house limits are generated once sufficient duplicate data is available to generate limits (usually a minimum of 20 to 30 analyses). If a duplicate is out of control, flag the results with the appropriate footnote. If the sample and the duplicate are less than 5 times the reporting limits and are within a range of ± the reporting limit, then the duplicate is considered to be in control. Note: If control limits are not specified in the SOP, use default limits of ± 20% RPD.

$$\frac{(|\text{Sample Result} - \text{Duplicate Result}|) \times 100}{(\text{Sample Result} + \text{Duplicate Result})/2} = \text{Duplicate RPD}$$

MATRIX SPIKE: The laboratory must add a known amount of each analyte to a minimum of 1 in 20 samples. The matrix spike recovery is calculated as shown below. Assess laboratory performance against the control limits that are specified in the SOP. In house limits are generated once sufficient matrix spike data is available to generate limits (usually a minimum of 20 to 30 analyses). If a matrix spike is out of control, then the results should be flagged with the appropriate footnote. If the matrix spike amount is less than one fourth of the sample amount, then the sample cannot be assessed against the control limits and should be footnoted to that effect. Note: If control limits are not specified in the SOP, then default limits of 75 to 125 percent should be used.

$$\frac{(\text{Spiked Sample Result} - \text{Sample Result})}{(\text{Amount Spiked})} \times 100 = \text{Matrix Spike Recovery}$$

MATRIX SPIKE DUPLICATES: Intralaboratory split samples spiked with identical concentrations of target analyte(s). The spiking occurs prior to sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.

$$\frac{(|\text{MS Result} - \text{MSD Result}|) \times 100}{(\text{MS Result} + \text{MSD Result})/2} = \text{MSD RPD}$$

METHOD BLANK. The laboratory must digest and analyze a method blank with each set of samples. A minimum of one method blank is required for every 20 samples. If no digestion step is required, then the method blank is equivalent to the reagent blank. The method blank must contain the parameter of interest at levels of less that the reporting limit for that parameter. If the method blank contains levels over the reporting limits, the samples must be redigested or redistilled and reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the method blank level. In addition, if all the samples are less than a client required limit and the method blank is also less than that limit, then the results can be reported as less than that limit.

METHOD DETECTION LIMITS (MDLS). The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. MDLs should be determined approximately once per year for frequently analyzed parameters.

REAGENT BLANK: The reagent blank is a blank that has the same matrix as the samples, i.e., all added reagents, but did not go through sample preparation procedures. The reagent blank is an indicator for contamination introduced during the analytical procedure. (Note: for methods requiring no preparation step, the reagent blank is equivalent to the method blank.) Either a reagent blank or a method blank must be analyzed with each batch of 20 samples or less. The concentration of the analyte of interest in the reagent blank must be less than the reporting limit for that analyte. If the reagent blank contains levels over the reporting limits, the samples must be reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the reagent blank level. In addition, if all the samples are less than a client required limit and the reagent blank is also less than that limit, then the results can be reported as less than that limit.

REAGENT GRADE: Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

REAGENT WATER: Water that has been generated by any method which would achieve the performance specifications for ASTM Type II water. For organic analyses, see the definition of organic-free reagent water.

STANDARD CURVE: A plot of concentrations of known analyte standards versus the instrument response to the analyte. Calibration standards are prepared by successively diluting a standard solution to produce working standards which cover the working range of the instrument. Standards should be prepared at the frequency specified in the appropriate section. The calibration standards should be prepared using the same type of acid or solvent and at the same concentration as will result in the samples following sample preparation.

LOWER LIMIT OF QUANTITATION CHECK (also referred to as CRI, CRA, or LLQC). For all runs, a low check at the level of the reporting limit must be analyzed at the beginning of the run before analyzing any samples, but not before the ICV. A method criterion of 70 to 130% recovery is applied to this low check standard. If this criterion is not met, then all samples associated with this CRA check must be reanalyzed along with a compliant CRA check.

5.0 HEALTH & SAFETY

5.1 The analyst must follow normal safety procedures as outlined in the Accutest Laboratory Safety Manual which includes the use of safety glasses and lab coats. In addition, all acids are corrosive and must be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical must be treated as a potential health hazard. Exposure to these reagents should be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets must be made available to all personnel involved in these analyses.

5.3 After the mercury digestate is reduced to Hg vapor, it must be handled in a closed system or in a hood to prevent inhalation of the toxic vapor. Make sure that the Hg instrument is vented directly to a hood.

6.0 PRESERVATION AND HOLDING TIME

6.1 All solid samples should be stored at 4 ± 2°C until the time of digestion.

6.2 All samples should be analyzed within 28 days of the date of sampling.

7.0 APPARATUS

7.1 Two Leeman instruments are available for analysis. One is a Leeman Hydra II AA automated analyzer and the other is a Leeman Hydra AA automated analyzer. Refer to the instrument manuals for further details on this instrumentation, including proper venting and safety requirements. Instrument maintenance is outlined below.

7.1.1 Change the sample tubing as needed.

7.1.2 Change the drying tubing as needed.

7.1.3 Clean the exterior of the instrument as needed.

7.1.4 Adjust the Hg lamp as needed. This can be done in the software on both instruments.

7.1.5 Complete any other maintenance required to maintain the instrument in good running order including, but not limited to, cleaning the cell, changing other tubing, changing the Hg lamp, etc.

7.2 Graphite heating block. Capable of heating at 95 ± 3 °C for 2 hours.

7.3 Digestion Bottles . Disposable plastic digestion tubes (65 ml volume) with tops for graphite heating block.

7.4 Calibrated glass tubes with verified 60.0 ml and 100.0 ml final volume calibration mark for bringing graphite heating block digestates to their final volume. (The 60.0 ml calibration is only required for water digestions).

7.4.1 At a minimum of once per year, the calibration of these bottles must be verified and documented in the Hg Bottle calibration log following the procedure outlined below.

7.4.2 Carefully measure 60.0 ml of room temperature (20 to 25 deg. C) deionized water with a class A to deliver volumetric cylinder and pour into the calibrated Hg bottle.

7.4.3 If the bottom of the meniscus is on the calibration line, then the bottle passes calibration and can be used.

7.4.4 If the bottom of the meniscus is not on the line, then the bottle should be removed from service and replaced with a newly calibrated bottle. New bottles are calibrated following the same procedure as above, except that a line must be etched into the bottle at the bottom of the meniscus of the 60 ml of DI water.

7.4.4.1 Two different lines for the same volume (i.e. 60 ml) cannot be etched on the same bottle as that may lead to confusion in the measurement of the final volume.

7.4.5 Repeat the steps in 7.4.2 through 7.4.4 using a 100 ml final volume instead of the 60 ml final volume.

7.5 Class A , to deliver, volumetric cylinders for measuring initial sample volumes and for calibrating glass tubes as outlined above.

7.6 Analytical Balance, 4 place. Calibration must be verified daily before use with NIST traceable weights.

7.7 Automatic pipettor bottles. The calibration on these bottles must be verified as outlined in EQA063.

7.8 Volumetric pipets, class A.

8.0 REAGENTS

All chemicals listed below are reagent grade unless otherwise specified. Deionized water should be used whenever water is required. All solutions listed below may be scaled up or down proportionally as needed. Different reagents are required for the different heating techniques.

8.1 Digestion Block Reagents.

8.1.1 Aqua Regia: Prepare immediately before use by carefully adding three volumes of concentrated HCl to one volume of concentrated nitric.

8.1.1.1 Make sure to only prepare the amount of acid that will be needed for the prep and analysis.

8.1.1.2 This preparation must be done in a hood.

8.1.2 Dilution Acid: To approximately 800 ml of DI water, add 37.5 ml of concentrated HCl and 12.5 ml of concentrated nitric acid. Dilute to 1000 ml with DI water and mix well. This dilution acid is used for making dilutions of digested samples from the digestion block digestion procedures.

8.1.3 Potassium permanganate, 5% solution: Dissolve 50 g of potassium permanganate in 1000 ml of DI water. Caution - Potassium permanganate is a strong oxidizing agent. Handle with care.

8.1.4 Stannous chloride. Add 7.5 ml of concentrated sulfuric acid to approximately 400 ml of DI water. Dilute to 500 ml with DI water and mix well. Add 50 g of stannous chloride and dissolve. Make sure that this solution is dissolved while in use.

8.1.4.1 Stannous sulfate may be used in place of stannous chloride.

8.1.4.2 If clogging occurs during analysis using the automated analyzer, then a less concentrated solution may be used.

8.1.5 Sodium chloride-Hydroxylamine hydrochloride or Sodium chloride-Hydroxylamine hydrosulfate. Add 240 g of sodium chloride and 240 g of hydroxylamine hydrochloride to 2000 ml of water. Mix well. Hydroxylamine sulfate may be used in place of hydroxylamine hydrochloride.

8.2 Mercury standard solutions.

8.2.1 10 ppm Hg solution. Using a 1.00 ml volumetric pipette, add 1.00 ml of 1000 ppm stock (to be purchased from a vendor such as Fisher) to a 100 ml volumetric flask containing approximately 75 ml of water and 2.0 ml of concentrated nitric acid. Dilute to volume with water and mix well. This standard may be held for up to 28 days.

8.2.1.1 The 10 ppm external source should be made up using a different mercury stock, and following the directions in 8.2.1.

8.2.2 100 ppb Hg solution. Using a 1.00 ml volumetric pipette, add 1.00 ml of 10 ppm Hg solution to a 100 ml volumetric flask containing approximately 75 ml of water and 2.0 ml of concentrated nitric acid. Dilute to volume with deionized water and mix well. This standard must be made fresh daily.

8.2.2.1 The 100 ppb external source should be made up following the directions in 8.2.2.

8.2.3 10 ppb Hg solution. Using a 10.0 ml volumetric pipette, add 10.0 ml of 100 ppb Hg solution to a 100 ml volumetric flask containing approximately 75 ml of DI water and 2.0 ml of concentrated nitric acid. Dilute to volume with deionized water and mix well. This standard must be made fresh daily.

9.0 INTERFERENCES

9.1 Potassium permanganate is added to eliminate possible sulfide interferences. Concentrations as high as 20 mg/kg of sulfide, as sodium sulfide, do not interfere with the recovery of added inorganic mercury in reagent water. High copper concentrations (> 10 mg/kg) may also interfere with mercury recoveries.

9.2 Samples that are high in chlorides may require additional permanganate because, during the oxidation step, chlorides are converted to free chlorine, which also absorbs radiation at 254 nm. Care must be taken to assure that free chlorine is absent before the mercury is reduced and analyzed. This may be accomplished by using an excess of the hydroxylamine hydrosulfate.

9.3 Certain volatile organics may also absorb at this wavelength and can interfere.

10.0 GRAPHITE DIGESTION BLOCK PROCEDURE FOR SOIL DIGESTION

10.1 Make up a standard curve consisting of 5 standards and a blank. Suggested concentrations are shown below. Different concentrations may also be used, as long as all of the method requirements are met. Make sure to clearly label each digestion tube. Calibration standards must be prepared fresh each day. Add 5 ml of DI water to each standard before digestion. The final concentration of Hg is calculated in the final digestate.

Ml of 10 ppb Hg solution	ml of 100 ppb Hg solution	Total ug of Hg	ug/L of Hg
0.000	0.000	0.000	0.000
2.00	0.000	0.020	0.20
5.00	0.000	0.050	0.50
0.00	1.00	0.100	1.00
0.00	2.50	0.250	2.50
0.00	5.00	0.500	5.00

10.2 Samples. For each sample, homogenize the sample well and weigh out a 0.5 to 0.6 g aliquot of the sample into one labeled digestion tube. A solid lab control should be prepared in the same manner.

10.3 Make up additional quality control samples as shown below. (Note: if a different standard curve is run, then the levels of the CCV and ICV standards should be adjusted accordingly in accordance with the requirements in the method.) Make sure to clearly label each digestion tube. Make sure to prepare enough CCV checks for the entire run. The ICV check must be from an alternate source of standards than the calibration curve and at a different level than the CCV or the calibration standards. A low check standard is also required. This 0.20 ug/l check can be made up as outlined for the standard curve.

Sample ID	ml of 100 ppb Hg solution	ml of DIwater	µg/l of Hg
CCV Check(s)	2.5	7.5	2.5
MB	0.0	10.0	0.0
MS	2.0	0.0	2.0
MSD	2.0	0.0	2.0
Duplicate*	0.0	0.0	0.0
ICV	3.0	7.0	3.0

*Per project specification.

10.4 To all samples, QC, and standards add 5 ml of DI water and 5 ml of aqua regia and then heat for 2 minutes in a digestion block at 95 ± 3 °C. These reagents can be added with a bottle pipettor that is accurate to within 90 to 110%.

10.5 Cool the samples and then add 25 ml of DI water and 15 ml of potassium permanganate solution to each sample and mix thoroughly. Allow the samples to stand for at least 15 minutes after the addition of the permanganate. If the sample decolorizes, add additional permanganate until the purple color persists.

10.5.1 These reagents can be added with a bottle pipettor that is accurate to within 90 to 110%.

10.5.2 For samples containing a mixture of solvent and water, take a sample aliquot of approximately 20 g (lower for higher solvent samples) of sample and add the reagents listed above. Pour the sample in a beaker and heat on a hot plate at 95 ± 3 °C until no solvent layer is visible. Then transfer the digestate to a digestion tube and proceed as outlined below. A method blank and spike blank must also be taken through this entire procedure.

10.6 Cap the samples and place them in the graphite digestion block for 30 minutes at 95 ± 3 °C. Record the temperature and time for each digestion batch on the analysis sheet. Remove and cool.

10.7 Enter the prep data into the LIMS system, double checking all weights and spike amounts. After the prep data is checked, it can be approved and is available for use in the final calculation.

11.0 MERCURY ANALYSIS PROCEDURE HYDRA AA

11.1 While the samples are digesting, begin setting up the Leeman analyzer following the steps outlined below. Additional instructions are available in the instrument operators manual.

11.1.1 Turn on the nitrogen and adjust to 60 to 90 psi. Turn on the instrument power if it is not already on.

11.1.2 Check the pump tubing and make sure that it is not flattened. Change if appropriate. Put the tubing in the clamps on the pump. Check the drying line and make sure that it is clean. Put fresh stannous chloride solution in the stannous chloride bottle. Fill the rinse bath or rinse bottle with fresh 10% nitric acid. The bath should be filled no more than ¾ full. Place the autosampler line and the stannous chloride line in the rinse container.

11.1.3 Turn on the analyzer and allow it to warm up.

11.1.3.1 In the software, go to the Runner section and select the control tab. Click on the Hg lamp and the pump. The gas will turn on automatically when the pump is turned off. If can also be turned on separately if necessary. The pump rates and gas pressure are set in the protocol. Refer to the instrument maintenance manual for more information on setting up a new protocol. If the

Hg lamp needs to be optimized, it can be done using the lab adjust on this page.

11.1.4 Tighten the pump clamps until the flow is coming evenly through the lines. Do not overtighten.

11.1.5 In the software, go to the Utility tab and pick the gas control test option. The output should be approximately 7 psi and the input should be between 60 to 90 psi. If the pressures are not correct, check with the area supervisor or manager before proceeding.

11.1.6 Start a batch to save your data.

11.1.6.1 Go to the sample runner tab and click on start new batch. The batch name is limited to 8 characters. The batch should normally be named H1 or H2 followed by the month and date, followed by the matrix designation for the batch, following by the run number. For example, the first water batch on instrument 2 for 3/24/03 would be named H20324w1. The realtime print option can also be turned on from this tab.

11.1.7 Set up autosampler racks containing the samples that are going to be run.

11.1.7.1 Go to main tab and click on the rack editor button. Enter your samples and the appropriate QC. CCV and CCB checks can be entered in the macro column. This tab may also be reached by clicking on the autosampler icon at the top of the page.

11.1.8 Set up the calibration.

11.1.8.1 Enter or verify the standard values. From the runner menu click on the standard tab. Click the buttons to the left of the standards that are to be run. Also click on the number of replicates to be run for each standard. Normally one replicate is run per standard. The standard concentrations are defined under the database menu under the line info tab. The check standard concentrations and acceptance ranges are also defined under this line info tab. Make sure to always click apply when any changes are made in a tab.

11.2 Finish the preparation of the samples and standards as outlined below.

11.2.1 For samples that were digested in the water bath or the graphite digestion block, add 6 ml of hydoxylamine hydrochloride or hydroxylamine hydrosulfate to each sample and standard and mix well. Transfer the entire digestate to a calibrated glass tube. Rinse the digestion tube 3 times with approximately 10 ml aliquots of DI water and add them to the digestate in the calibrated glass tube. Then bring the sample to a final volume of 100 ml with DI water and mix well.

11.2.1.1 These reagents can be added with a bottle pipettor that is accurate to within 90 to 110%.

11.3 Measure out aliquots of the digested standards and samples into the autosampler cups. Work from the prep log and double check all transfers. Let all samples sit uncovered in the open autosampler vials for a minimum of one minute. Place the racks in the autosampler. Move the stannous chloride line into the stannous chloride bottle.

11.4 Start the calibration.

11.4.1 Turn on the real time report by checking the real time printing option on the runner menu either under main or under sample. Then go to the runner menu and the standard tab. Push the standard auto button. The calibration curve will be run by the autosampler. When the curve is complete, go to the database menu and click the calibration curve tab. Check to make sure that all acceptance criteria are met and then accept the curve. See section 13.3 for calibration curve criteria. Make sure that the curve is printed as soon as it is accepted.

11.5 After the calibration has been accepted, start to run the samples.

11.5.1 Go to the runner menu and the sample tab. Pick the autosampler rack that is to be run and type in the start cup and the end cup. Then push the button for run auto.

11.5.2 Review the data. Any samples that are over the range of the curve should be diluted with the dilution acid (see 8.1.2) and reanalyzed. It is recommended that any sample analyzed after a sample with a value over the curve be reanalyzed for confirmation. Make sure to bracket every 10 samples with CCV and CCB checks.

11.6 Both paper and electronic reports can be generated using the report option. Never delete any samples from the reports. Electronic reports should be transferred into the LIMS system where the final calculations are done.

11.6.1 Go to the data base menu and pick the report tab. Make sure that the correct report specification has been chosen (normally Accutest). Pick the batch that is to be printed and then push the generate report button. Generate both the electronic reports (prn file) and printed reports (report) from this menu.

11.7 The calculations are done in the LIMS as described below. . For soils, the calculation shown below is used. A final volume of 100 ml is used for calculation purposes. (The final volume is factored out since all standards and samples are brought up to the same final volume and standard concentrations are calculated based on 100 ml.)

$$\text{Final sample concentration in mg/kg} = \frac{\text{concentration in the digestate in ug/l x final volume}}{\text{Initial weight in g x (\%solids/100)}}$$

11.8 Review the data in the LIMS, adding comments and accepting results as appropriate.

11.9 Shut down the instruments.

11.9.1 To shut down the Hydra AA instrument, move the stannous chloride line from the stannous chloride bottle to the rinse container. Let the system rinse with 10% nitric for several minutes. Then switch the bath to DI water and let rinse for several more

minutes. Then empty the rinse bath and let the pump and gas run until the lines are completely dry. Go to Taskmaster and select the standby mode option. Release the tension on all of the pump clamps.

12.0 MERCURY ANALYSIS PROCEDURE HYDRA AA II

12.1 While the samples are digesting, begin setting up the Leeman analyzer following the steps outlined below. Additional instructions are available in the instrument operators manual.

12.1.1 Turn on the nitrogen and adjust to 60 to 90 psi. Turn on the instrument power if it is not already on.

12.1.2 Check the pump tubing and make sure that it is not flattened. Change if appropriate. Put the tubing in the clamps on the pump. Check the drying line and make sure that it is clean. Put fresh stannous chloride solution in the stannous chloride bottle. Fill the rinse bath or rinse bottle with fresh 10% nitric acid. The bath should be filled no more than ¾ full. Place the autosampler line and the stannous chloride line in the rinse container.

12.1.3 Turn on the analyzer and allow it to warm up.

12.1.3.1 Open the Envoy software. Go to Method and click Instrument Control. On the Instrument Control page, click the startup icon. This will turn on the lamp, gas, and pump. You may also turn on/off the lamp, gas and pump individually on the Instrument Control Page.

12.1.4 Tighten the pump clamps until the flow is coming evenly through the lines. Do not overtighten.

12.1.5 Go to the Instrument control tab and pick the gas control test option. The input should be approximately 0.25 LPM. If the pressures are not correct, check with the area supervisor or manager before proceeding.

12.1.6 Start a batch to save your data.

12.1.6.1 Create a new chapter (Data File) by clicking Analysis. The batch should normally be named H5 followed by the month date and year, followed by the matrix designation for the batch, following by the run number. For example, the first water batch on instrument for 3/24/03 would be named H5032411w1. The realtime print option can also be turned on from this tab.

12.1.7 Set up autosampler racks containing the samples that are going to be run.

12.1.7.1 Create a new sequence by clicking sequence-new. Type the sequence name. After typing the samples in to sequence page make sure to click update and save. CCV and CCB checks can be entered in the macro column of the sequence page.

12.1.8 Set up the calibration.

12.1.8.1 For the Hydra AA II, go to the Method menu, enter or verify the standard concentration by clicking on the standard tab. Also select number of replicates to be run for each standard. Normally one replicate is run per standard. The check standard concentrations and acceptance ranges are also defined under this standard info tab. Make sure to always click apply when any changes are made in a tab.

12.2 Finish the preparation of the samples and standards as outlined below.

12.2.1 For samples that were digested in the water bath or the graphite digestion block, add 6 ml of hydoxylamine hydrochloride or hydroxylamine hydrosulfate to each sample and standard and mix well. Transfer the entire digestate to a calibrated glass tube. Rinse the digestion tube 3 times with approximately 10 ml aliquots of DI water and add them to the digestate in the calibrated glass tube. Then bring the sample to a final volume of 100 ml with DI water and mix well.

12.2.1.1 These reagents can be added with a bottle pipettor that is accurate to within 90 to 110%.

12.3 Measure out aliquots of the digested standards and samples into the autosampler cups. Work from the prep log and double check all transfers. Let all samples sit uncovered in the open autosampler vials for a minimum of one minute. Place the racks in the autosampler. Move the stannous chloride line into the stannous chloride bottle.

12.4 Start the calibration.

12.4.1 Click run sequence. The instrument will run the calibration and then pause. Click stop. Go to the Calibration page. Accept the calibration and then print the calibration. Click the Document icon, then choose HG5-PDF. Rename the file as MA*****_cal.

12.5 After the calibration has been accepted, start to run the samples.

12.5.1 For the Hydra AA II, go to the Sequence page. Right click on the first sample (i.e. ICV) and click start from here.

12.5.2 Review the data. Any samples that are over the range of the curve should be diluted with the dilution acid (see 8.1.2) and reanalyzed. It is recommended that any sample analyzed after a sample with a value over the curve be reanalyzed for confirmation. Make sure to bracket every 10 samples with CCV and CCB checks.

12.6 Both paper and electronic reports can be generated using the report option. Never delete any samples from the reports. Electronic reports should be transferred into the LIMS system where the final calculations are done.

12.6.1 Go to analysis-Click result-Click chapter. Then go to report and select report spec. The normal report spec is "ACCUTEST". Click OK. Click on chapter in order to select all samples. Then click report output and then csv.file. Save as MA*****.csv. To print, select printer output and then type the report title (i.e. MA*****) and enter OK.

12.7 The calculations are done in the LIMS as described below. . For soils, the calculation shown below is used. A final volume of 100 ml is used for calculation purposes. (The final volume is factored out since all standards and samples are brought up to the same final volume and standard concentrations are calculated based on 100 ml.)

$$\text{Final sample concentration in mg/kg} = \frac{\text{concentration in the digestate in ug/l x final volume}}{\text{initial weight in g x (\%solids/100)}}$$

12.8 Review the data in the LIMS, adding comments and accepting results as appropriate.

12.9 Shut down the instruments.

12.9.1 To shut down the Hydra AA II, move the stannous chloride line from the stannous chloride bottle to the 10% HNO3 rinse bottle. Let the system rinse with 10% HNO3 for several minutes. Then switch the line to DI water bottle and let rinse for several more minutes. Let the pump and gas run until the lines are completely dry. Then go to instrument control menu and click off icon for Lamp, Gas and Pump.

13.0 QUALITY CONTROL

Below is a summary of the quality control requirements for this method. Make sure to check with the laboratory supervisor or manager for any additional client specific quality control requirements.

13.1 Instrument Detection Limits (IDLs). The instrument detection limits are determined by multiplying by 3, the average of the standard deviations obtained on three nonconsecutive days from the analysis of 7 consecutive replicates of a standard solution at a concentration from 3 to 5 times the estimated detection limit. IDLs must be done quarterly (every 3 months) for each instrument.

13.2 Method Detection Limits (MDLs). MDLs should be established using a solution spiked at approximately 3 times the estimated detection limit. To determine the MDL values, take seven replicate aliquots of the spiked sample and process through the entire analytical method. The MDL is calculated by multiplying the standard deviation of the replicate analyses by 3.143, which is the student's t value for a 99% confidence level. MDLs should be determined approximately once per year or whenever there is a significant change in the background or instrument response.

13.3 Instrument Calibration. The instrument must be calibrated daily or at a minimum of once every 24 hours and each time the instrument is set up. Calibration standards must be digested using the same procedure as the samples. A minimum of a blank and 5 standards are required. The correlation coefficient of the curve must be a minimum of 0.995. No samples should be analyzed until all of the calibration criteria are met.

13.3.1 A linear calibration using the equation $y = mx + b$ is applied where m is the slope and b is the intercept. The calibration is not forced through zero.

13.3.2 The correlation coefficient is calculated using the following equation:

$$Correl(X,Y) = \frac{\sum(x-\bar{x})(y-\bar{y})}{\sqrt{\sum(x-\bar{x})^2\sum(y-\bar{y})^2}}$$

where x is the measured absorbance and y is the standard concentration.

13.3.3 If the calibration curve does not meet criteria, and is redigestion, then any samples digested along with that calibration curve must also be redigested.

13.4 Initial Calibration Verification Standard (ICV)). During each analysis, a standard from a different source than the calibration standard should be analyzed. Normally this is analyzed at the beginning of the run. For this method, the ICV should be within 10 percent of the true value. When the measurements exceed these control limits, the analysis shall be terminated, and the problem corrected before proceeding. All reported results must be bracketed by compliant QC. The exception is, if the ICV is biased high (110 to 150 % recovery) and no mercury is found in the samples, then the sample results may be reported for mercury.

13.5 Continuing Calibration Verification. Analyze the continuing calibration verification solution and the continuing calibration blank after every tenth sample and at the end of the sample run. If the CCV solution is not within 20 percent of the true value, then no samples can be reported in the area bracketed by that CCV. (Note: the exception is if the CCV is biased high and the samples are less than the detection limit. In that case, the samples can be reported with no flag.)

13.6 Continuing Calibration Blank. Analyze the continuing calibration verification solution and the continuing calibration blank after every tenth sample and at the end of the sample run. If the CCB is not less than the reporting limit, then no samples can be reported in the area bracketed by the failing CCB.

13.7 CRA (Low) Check or LLQC (Lower Limit of Quantitation Check). For all runs, a low check at the level of the reporting limit must be analyzed at the beginning of the run before analyzing any samples, but not before the ICV. A criterion of 50 to 150% recovery is applied to this low check standard. If this criterion is not met, then all samples associated with this CRA check must be reanalyzed along with a compliant CRA check.

13.7.1 A number of clients have specific program requirements for frequency and recovery ranges on CRA checks. Check with the metals supervisor for additional information on these programs.

13.7.2 If the CRA is biased high and there is no mercury found in the samples, then the sample results may be reported for mercury. If the CRA is biased high and there is mercury found in the samples, then the samples with Hg at levels ranging from the CCV to the high standard may be reported. Samples with levels of mercury between the CRA and the CCV standard may be biased high and cannot be reported.

13.8 Method Blank. The laboratory must digest and analyze a method blank with each batch of 20 samples. A minimum of one method blank is required for every 20 samples. A sample batch is defined as a maximum of 20 field samples in a preparation batch over a time period of 24 hours. A matrix spike/matrix spike duplicate, matrix spikes and/or duplicate is required

every 20 samples. The method blank must contain mercury at less that the reporting limit. If the method blank contains over that limit, the samples must be redigested or reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the method blank level. In addition, if all the samples are less than a client required limit and the method blank is also less than that limit, then the results can be reported as less than that limit.

13.9 Lab Control Sample. The laboratory must digest and analyze a laboratory control sample or spike blank with each set of samples. A minimum of one lab control or spike blank is required for every 20 samples. Note: For soils, if a lab control is not available, a spike blank can be used. For a running batch, a new lab control sample is required for each different digestion day. The laboratory should assess laboratory performance of an aqueous lab control against recovery limits of 80 to 120%. In house lab control limits may also be generated to support these default limits. For solid lab controls, the elements should be within the range given by the lab control supplier. If the lab control is outside of the control limits for a given element, all samples must be redigested and reanalyzed for that element. The exception is if the lab control recovery is high and the results of the samples to be reported are less than the reporting limit. In that case, the sample results can be reported with no flag.

13.10 Matrix Spike. The laboratory must add a known amount of each analyte to a minimum of 1 in 20 samples. The matrix spike recovery is calculated as shown below. The laboratory should assess the matrix spike recovery against control limits of 80 to 120. (In house control limits are generated annually for information purposes only.). If a matrix spike is out of control, then the results should be flagged with the appropriate footnote. If the matrix spike amount is less than one fourth of the sample amount, then the sample cannot be assessed against the control limits and should be footnoted to that effect. Note: Both the matrix spike amount and the sample amount are calculated to the IDL for any given element. Any value less than the IDL is treated as zero.

((Spiked Sample Result - Sample Result)/Amount Spiked) x 100 = matrix spike recovery

13.11 Matrix Spike Duplicate or Matrix Duplicate. The laboratory must digest a matrix spike duplicate or a duplicate sample for a minimum of 1 in 20 samples. Matrix spike duplicates are normally used unless otherwise specified by client requirements. The relative percent difference (rpd) between the matrix spike duplicate and the matrix spike or between the duplicate and the original sample should be assessed. The rpds are calculated as shown below and should be assessed against a limit of 20% RPD. (In house control limits are generated annually for information purposes only.). If a matrix spike duplicate or a duplicate is out of control, then the results should be flagged with the appropriate footnote. If the sample and the duplicate are less than 5 times the reporting limits and are within a range of $\pm$ the reporting limit, then the duplicate is considered to be in control. Note: Both the duplicate amount and the sample amount are calculated to the IDL for any given element. Any value less than the IDL is treated as zero.

$$\frac{(\text{Sample Result} - \text{Duplicate Result}) \times 100}{(\text{Sample Result} + \text{Duplicate Result}) \times 0.5} = \% \text{ RPD}$$

or

$$\frac{(\text{MS Result} - \text{MSD Result}) \times 100}{(\text{MS Result} + \text{MSD Result})/2} = \text{MSD RPD}$$

14.0 DOCUMENTATION REQUIREMENTS

Refer to the laboratory Quality Assurance Manual for additional documentation requirements.

14.1 Sample Worksheets. Digestion data sheets for the Hg soil samples must show all digestion information including the sample ID's, sample weights, bottle numbers, type of heating used, start times, end times, and pressure or temperature, as appropriate for all digestions. All sample information should be clearly entered on these sheets. In addition, any unusual characteristics of the samples or the digestion procedure should be noted in the comments sections. Make sure also that all dilutions are clearly documented.

14.2 Make sure to record thermometer ID, correction factor, and corrected and uncorrected temperatures for all temperature measurements.

14.3 Standards and Reagents. All stocks and reagents must be recorded in the reagent log book. All standards should be recorded on the digestion log with the samples.

14.4 Any run comments should be written on the raw data for the analysis and on the run log in the LIMS.

14.5 Annual bottle calibration verifications must be documented in the Mercury Bottle calibration log.

15.0 DATA REVIEW AND REPORTING

15.1 All samples should be updated to QC batches in the LIMS system. The analyst is responsible for reviewing all data for compliance with the QC outlined in this SOP. They are responsible for making sure that the raw data is fully documented and it is loaded into the LIMS system. They are responsible for submitting samples for redigestion and reanalysis, when appropriate.

15.2 After the analyst review is completed, the supervisor or a designated reviewer shall review the run for technical compliance to the SOP. The reviewer is also responsible for making sure that the QC calculations are done correctly and that appropriate flags are added.

15.3 After the reviewer completes their review, the data is released for client access in the LIMS. The raw data and the run log are submitted to the area manager. The manager periodically does an additional review on data for technical completeness. Any hardcopy raw data is transferred to the report generation department for scanning and storage. Instrument data is transferred electronically.

16.0 POLLUTION PREVENTION & WASTE MANAGEMENT

16.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP.

All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 16.2.

16.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, EHS004. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:

16.2.1 Non hazardous aqueous wastes.

16.2.2 Hazardous aqueous wastes.

16.2.3 Chlorinated organic solvents.

16.2.4 Non-chlorinated organic solvents.

16.2.5 Hazardous solid wastes.

16.2.6 Non hazardous aqueous wastes.

17.0 ADDITIONAL REFERENCES

17.1 Leeman Hydra AA instrument manual.

17.2 Leeman Hydra AA II instrument manual.

ACCUTEST LABORATORIES
STANDARD OPERATING PROCEDURE

Lab Manager Nancy Cole

QA Manager [signature]

Effective Date: 9/12/11

TITLE: DIGESTION OF NON-POTABLE WATERS FOR ICP OR ICP-MS ANALYSIS.

REFERENCES: SW846 3010A

Revised Sections: ***8.5, 10.3.5***

1.0 SCOPE & APPLICATION

1.1 This method is applicable for the digestion of aqueous samples, TCLP extracts, and wastes that contain small amounts of suspended solids. After digestion, the samples can be analyzed by ICP or by ICP-MS. This digestion method is based on SW846 3010A .

2.0 SUMMARY

2.1 Samples for metals analysis are digested on a hot plate or in a digestion block at 90 to 95° C to solubilize the metals before analysis. Nitric and hydrochloric acids are used for digestion.

3.0 REPORTING LIMIT AND METHOD DETECTION LIMIT

3.1 Reporting Limit. See determinative method.

3.2 Method Detection Limit. MDLs must be established using a solution spiked at approximately 3 to 5 times the estimated detection limit. To determine the MDL values, take seven replicate aliquots of the spiked sample and process through the entire analytical method. The MDL is calculated by multiplying the standard deviation of three replicate analyses by 3.14, which is the student's t value for a 99% confidence level. MDLs must be determined approximately once per year for frequently analyzed parameters.

4.0 DEFINITIONS

BATCH: A group of samples which behave similarly with respect to the sampling or the testing procedures being employed and which are processed as a batch. For QC purposes, if the number of samples in a group is greater than 20, then each group of 20 samples or less will all be handled as a separate batch.

SPIKE BLANK OR LAB CONTROL SAMPLE. Digest and analyze a laboratory control sample or spike blank with each set of samples. A minimum of one lab control sample or spike blank is required for every 20 samples. Assess laboratory performance against the control limits specified in the SOP. In house limits should also be generated once sufficient external check standard data is available to generate limits (usually a minimum of 20 to 30 analyses). If the lab control is outside of the control limits for a parameter, all samples must be redigested or redistilled and reanalyzed for that parameter. The exception is if the lab control recovery is high and the results of the samples to be reported are less than the reporting limit. In that case, the sample results can be reported with no flag. Note: If control limits are not specified in the SOP, then default limits of 80 to 120 percent should be used.

MATRIX: The component or substrate (e.g., water, soil) which contains the analyte of interest.

MATRIX DUPLICATE: A duplicate sample is digested at a minimum of 1 in 20 samples. The relative percent difference (RPD) between the duplicate and the sample must be assessed. The duplicate RPD is calculated as shown below. Assess laboratory performance against the control limits that are specified in the SOP. In house limits are generated once sufficient duplicate data is available to generate limits (usually a minimum of 20 to 30 analyses). If a duplicate is out of control, flag the results with the appropriate footnote. If the sample and the duplicate are less than 5 times the reporting limits and are within a range of ± the reporting limit, then the duplicate is considered to be in control. Note: If control limits are not specified in the SOP, use default limits of ± 20% RPD.

$$\frac{(|\text{Sample Result} - \text{Duplicate Result}|) \times 100}{(\text{Sample Result} + \text{Duplicate Result})/2} = \text{Duplicate RPD}$$

MATRIX SPIKE: The laboratory must add a known amount of each analyte to a minimum of 1 in 20 samples. The matrix spike recovery is calculated as shown below. Assess laboratory performance against the control limits that are specified in the SOP. In house limits are generated once sufficient matrix spike data is available to generate limits (usually a minimum of 20 to 30 analyses). If a matrix spike is out of control, then the results must be flagged with the appropriate footnote. If the matrix spike amount is less than one fourth of the sample amount, then the sample cannot be assessed against the control limits and must be footnoted to that effect. Note: If control limits are not specified in the SOP, then default limits of 75 to 125 percent should be used.

$$\frac{(\text{Spiked Sample Result} - \text{Sample Result})}{(\text{Amount Spiked})} \times 100 = \text{Matrix Spike Recovery}$$

MATRIX SPIKE DUPLICATES: Intralaboratory split samples spiked with identical concentrations of target analyte(s). The spiking occurs prior to sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.

$$\frac{(|\text{MS Result} - \text{MSD Result}|) \times 100}{(\text{MS Result} + \text{MSD Result})/2} = \text{MSD RPD}$$

METHOD BLANK. The laboratory must digest and analyze a method blank with each set of samples. A minimum of one method blank is required for every 20 samples. For a running batch, a new method blank is required for each different digestion day. If no digestion step is required, then the method blank is equivalent to the reagent blank. The method blank must contain the parameter of interest at levels of less that the reporting limit for that parameter. If the method blank contains levels over the reporting limits, the samples must be redigested or redistilled and reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the method blank level. In addition, if all the samples are less than a client required limit and the method blank is also less than that limit, then the results can be reported as less than that limit.

METHOD DETECTION LIMITS (MDLS). The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. MDLs are determined approximately once per year for frequently analyzed parameters.

REAGENT BLANK: The reagent blank is a blank that has the same matrix as the samples, i.e., all added reagents, but did not go through sample preparation procedures. The reagent blank is an indicator for contamination introduced during the analytical procedure. (Note: for methods requiring no preparation step, the reagent blank is equivalent to the method blank.) Either a reagent blank or a method blank must be analyzed with each batch of 20 samples or less. The concentration of the analyte of interest in the reagent blank must be less than the reporting limit for that analyte. If the reagent blank contains levels over

the reporting limits, the samples must be reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the reagent blank level. In addition, if all the samples are less than a client required limit and the reagent blank is also less than that limit, then the results can be reported as less than that limit.

REAGENT GRADE: Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

REAGENT WATER: Water that has been generated by any method which would achieve the performance specifications for ASTM Type II water. For organic analyses, see the definition of organic-free reagent water.

REFERENCE MATERIAL: A material containing known quantities of target analytes in solution or in a homogeneous matrix. It is used to document the bias of the analytical process.

5.0 HEALTH & SAFETY

5.1 The analyst must follow normal safety procedures as outlined in the Accutest Laboratory Safety Manual which includes the use of safety glasses and lab coats. All digestions must be done in a hood. In addition, all acids are corrosive and must be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical must be treated as a potential health hazard. Expose to these reagents must be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemical specified in this method. A reference file of date handling sheets must be made available to all personnel involved in these analyses.

6.0 COLLECTION, PRESERVATION, & HOLDING TIMES

6.1 All samples must be preserved with nitric acid at the time of collection to a pH of < 2.

6.1.1 Samples received without preservation must be preserved following the specifications in the Accutest QSM.

6.2 All samples must be digested and analyzed within 6 months of the time of collection.

7.0 APPARATUS AND MATERIALS

7.1 The apparatus needed for this digestion procedure are listed below. It should be noted that hot plates and beakers with watch glasses may be used in place of the digestion block and digestion tubes.

7.2 Digestion block. Temperature adjustable and designed to hold sample digestion tubes and capable of maintaining temperatures from 90 to 95°C.

7.3 Thermometers, calibrated with NIST traceable thermometers. To be used to monitor digestion temperatures.

7.4 Sample digestion tubes and ribbed watch glasses.

7.4.1 If sample digestion tubes are used to measure initial and final volumes, then they must be calibrated following the procedure outlined in EMP203, the digestion tube calibration SOP.

7.5 Automatic pipeter bottles.

7.6 50 ml volumetric flasks or 50 ml TD volumetric cylinders (Class A).

7.6.1 All glassware must be washed with soap and tap water and then soaked in a 10% nitric acid bath for several hours. It must then be rinsed at least 3 times with distilled, deionized water.

7.7 Glass funnels.

7.8 Whatman #41 filter paper or equivalent.

7.9 Volumetric pipets, class A.

7.10 pH paper.

8.0 STANDARDS & REAGENTS

8.1 All chemicals listed below are reagent grade unless otherwise specified. Deionized water must be used whenever water is required.

8.2 Hydrochloric acid. Baker instra-analyzed or equivalent.

8.3 Nitric Acid. Baker instra-analyzed or equivalent.

8.4 Metals Spiking Solutions. All metals spiking solutions must be made up in a solution of 2 % nitric acid following the procedures outlined in the metals standards preparation SOP.

8.5 Hydrogen Peroxide, 30%. (Used only if sulfur is an analyte of interest).

9.0 INTERFERENCES

9.1 Organics in a matrix may cause interferences if the sample is not digested rigorously enough. In addition, high levels of acids in the final digestate may cause interferences in the analysis. Both of these interferences can be avoided by choosing the appropriate digestion method and by bringing the sample to an appropriate final volume. For a discussion of other interferences, refer to specific analytical methods.

10.0 PROCEDURE

10.1 Below is the procedure to be followed for the digestion of aqueous samples prior to ICP or ICP-MS analysis.

10.2 Before starting the analysis, check the initial pH of the sample with pH paper and verify that it is < 2. If it is < 2, then enter a Y in the pH check column on the metals prep logs. If the sample is not < 2, then adjust it to < 2 with nitric acid and record both the initial and final pH on the digestion log.

10.2.1 For highly basic or buffered samples, where more than a few drops of acid are required, adjust an aliquot of the sample rather than the whole amount and record the amount of acid used for the adjustment.

10.2.2 Samples for TCLP matrix or leachate spikes will be received unpreserved from the TCLP leaching area. These must be aliquoted, spiked, and preserved on receipt in the metals prep area.

10.2.3 For some clients, additional documentation of the pH adjustment is necessary. For all samples from Ohio, the pH adjustment must be noted in the case narrative or conformance summary for the samples.

10.3 Measure out 50 ml of each sample into a labeled digestion tube or into a beaker. The sample may be measured by using a graduated cylinder or by using a calibrated digestion tube. Make sure that the sample identification is accurately recorded with the digestion tube/beaker numbers on the sample digestion log. In addition to the samples, a Spike Blank or a Lab Control and a Method Blank must be set up with each batch of 20 samples or less. A Matrix Spike and a Matrix Spike Duplicate (or Matrix Duplicate) must be set up with each batch of 20 samples. Matrix Spike Duplicates are normally used unless otherwise specified by client requirements. Check with the metals supervisor for spiking levels to use for the matrix spikes and the spike blank or lab control.

10.3.1 For the method blank, add 50 ml of deionized water to the digestion tube.

10.3.2 For the lab control, add 50 ml of lab control solution to the digestion tube. Refer to the metals spiking solution SOP, EMP202, for information on the preparation of the lab control solution.

10.3.3 For the matrix spike and matrix spike duplicates, add the spiking solution directly to the 50 ml of sample in the designated tubes. Refer to the metals spiking solution SOP, EMP202, for information on the preparation and amounts of spiking solution required.

10.3.4 TCLP blank spikes must be prepared using 50 ml of the appropriate TCLPE extraction fluid.

10.3.5 If the sample is going to be analyzed for sulfur by method 6010, then add 5 ml of peroxide at room temperature to the sample and QC and let them sit for 30 minutes before proceeding. The purpose of this step is to oxidize any sulfide that is present before the digestion.

10.4 Add 1.5 ml of concentrated nitric acid to all quality control and samples.

10.5 Place the labeled tubes into a digestion block and cover with watch glasses. (If using beakers, cover the beakers with watch glasses and place them on a hot plate.) Heat the samples at 90 to 95°C until they come to a gentle reflux and then continue to heat the samples until they are evaporated to near dryness, for example 10 ml or less. After the heating is complete, allow the samples to cool.

10.5.1 Watch glasses may be removed if necessary to allow for faster volume reduction, but should be left on for the maximum time possible to limit contamination.

10.6 Add an additional 1.5 ml of concentrated nitric acid to all quality control and samples. Continue heating the samples at a gentle reflux until the sample is completely digested. (More acid may be added as necessary to complete the digestion.)

10.6.1 Signs of a complete digestion are if the digestate is light in color and/or if the appearance of the sample does not change with continued refluxing.

10.7 Add 5 ml of 1:1 HCl to each sample and reflux for an additional 15 minutes.

10.8 Wash down the beaker walls and watch glass with DI water. Bring the sample to a final volume of 50 ml with deionized water. The sample is now ready for analysis by ICP.

10.8.1 If the sample contains particulate, it can be filtered through Whatman # 41 filter paper (or equivalent) before analysis. If any samples in a batch are filtered, then all of the associated quality control must also be filtered in the same manner.

10.8.2 For ICP-MS analysis, the digestate is normally further diluted at the instrument before analysis (at least by a factor of 2) and the dilution factor must be added to the instrument file.

11.0 QUALITY ASSURANCE

11.1 A sample batch is defined as a maximum of 20 field samples in a preparation batch over a time period of 24 hours. A matrix spike/matrix spike duplicate, matrix spikes and/or duplicate is required every 20 samples.

11.2 For each digestion batch of 20 samples or less, a lab control (and a spike blank) and a method blank is prepared. Besides a lab control, a spike blank is also digested when analyzing the odd elements, such as B, Si, Sr, Sn and Pd.

11.3 For every 20 samples, digest a matrix spike/matrix spike duplicate pair instead of a matrix spike/ duplicate pair unless otherwise requested by a client.

11.4 Refer to the analytical methods SOPs for additional information on method quality control.

12.0 DOCUMENTATION

12.1 All digestion information must be entered on a digestion log. The information required includes the sample identification, the initial sample volume, the final sample volume, the initial sample pH, the acids used (including both amount and lot number), the spikes used, and the digestion times and temperatures, and the thermometer identification. Both the corrected and uncorrected temperatures must be recorded. If filtration is done, the filter type and lot must also be recorded.

12.2 The analyst must write additional information such as unusual sample characteristics in the Comments section. All spiking solution information must be entered in the metals spiking solution notebook.

13.0 DATA REVIEW & REPORTING

13.1 The prep analyst is responsible for updating the samples to SCH status in the LIMS system and for entering the prep information into the LIMS. This may be done manually or electronically. When the prep information is in the LIMS, the completed paperwork must be turned into the metals supervisor for review.

13.2 The supervisor or a metals analyst reviews the preparation information and approves the data in the LIMS system.

13.3 The original paperwork is submitted to the report generation department for filing.

14.0 POLLUTION PREVENTION & WASTE MANAGEMENT

14.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards,

reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 14.2.

14.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, EHS004. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:

14.2.1 Non hazardous aqueous wastes.

14.2.2 Hazardous aqueous wastes.

14.2.3 Chlorinated organic solvents.

14.2.4 Non-chlorinated organic solvents.

14.2.5 Hazardous solid wastes.

14.2.6 Non-hazardous solid wastes.

15.0 ADDITIONAL REFERENCES

15.1 Refer to the ICP and ICPMS analytical SOP's, the spiking procedure SOP (EMP202), and the digestion tube calibration SOP (EMP203).

ACCUTEST LABORATORIES
STANDARD OPERATING PROCEDURE

Lab Manager:_____

QA Manager:_____

Effective Date: _____

TEST NAME: **DIGESTION OF SOILS FOR ICP AND ICP-MS ANALYSIS**

REFERENCE: SW846 3050B (Revision 2, December 1996)

Revised Sections, 10.2.3, 10.2.4, 12.1

1.0 SCOPE AND APPLICATION

1.1 This method is applicable for the digestion of sediments, soils, sludges, solid wastes, and wipes. After digestion, the samples can be analyzed by ICAP or by ICP-MS (or by graphite furnace AA for antimony). This digestion method is based upon SW846 method 3050B, Revision 2, 12/96.

2.0 SUMMARY

2.1 For the digestion of samples, a representative 1-2 gram (wet weight) or 1 gram (dry weight) sample is digested with repeated additions of nitric acid (HNO_3) and hydrogen peroxide (H_2O_2). Then hydrochloric acid (HCl) is added to the initial digestate and the sample is refluxed. In an optional step to increase the solubility of some metals, this digestate is filtered and the filter paper and residues are rinsed, first with hot HCl and then hot reagent water. Filter paper and residue are returned to the digestion flask, refluxed with additional HCl and then filtered again. The digestate is then diluted to a final volume of 100 mL.

2.2 In method 3050B, the final HCl addition is not included for ICP-MS digestates as chloride is an interference for a number of elements on ICP-MS. However, the HCl is necessary for good solubility of many elements. HCl interferences at the ICP-MS can normally be addressed with corrections at the ICP-MS. Therefore it is recommended that HCl be added for ICP-MS digestions by this method unless otherwise directed by the lab supervisor or manager.

2.0 REPORTING LIMIT AND METHOD DETECTION LIMIT

3.1 See determinative method.

4.0 DEFINITIONS

BATCH: A group of samples which behave similarly with respect to the sampling or the testing procedures being employed and which are processed as a unit. For QC purposes, if the number of samples in a group is greater than 20, then each group of 20 samples or less will all be handled as a separate batch.

SPIKE BLANK OR LAB CONTROL SAMPLE. Digest a laboratory control sample or spike blank with each set of samples. A minimum of one lab control sample or spike blank is required for every 20 samples. Assess laboratory performance against the control limits specified in the SOP. In house limits should also be generated once sufficient external check standard data is available to generate limits (usually a minimum of 20 to 30 analyses). If the lab control is outside of the control limits for a parameter, all samples must be redigested or redistilled and reanalyzed for that parameter. The exception is if the lab control recovery is high and the results of the samples to be reported are less than the reporting limit. In that case, the sample results can be reported with no flag. Note: If control limits are not specified in the SOP, then default limits of 80 to 120 percent should be used.

MATRIX: The component or substrate (e.g., water, soil) which contains the analyte of interest.

MATRIX DUPLICATE: A duplicate sample is digested at a minimum of 1 in 20 samples. The relative percent difference (RPD) between the duplicate and the sample should be assessed. The duplicate RPD is calculated as shown below. Assess laboratory performance against the control limits that are specified in the SOP. In house limits are generated once sufficient duplicate data is available to generate limits (usually a minimum of 20 to 30 analyses). If a duplicate is out of control, flag the results with the appropriate footnote. If the sample and the duplicate are less than 5 times the reporting limits and are within a range of ± the reporting limit, then the duplicate is considered to be in control. Note: If control limits are not specified in the SOP, use default limits of ± 20% RPD.

$$\frac{(|\text{Sample Result} - \text{Duplicate Result}|) \times 100}{(\text{Sample Result} + \text{Duplicate Result})/2} = \text{Duplicate RPD}$$

MATRIX SPIKE: The laboratory must add a known amount of each analyte to a minimum of 1 in 20 samples. The matrix spike recovery is calculated as shown below. Assess laboratory performance against the control limits that are specified in the SOP. In house limits are generated once sufficient matrix spike data is available to generate limits (usually a minimum of 20 to 30 analyses). If a matrix spike is out of control, then the results should be flagged with the appropriate footnote. If the matrix spike amount is less than one fourth of the sample amount, then the sample cannot be assessed against the control limits and should be footnoted to that effect. Note: If control limits are not specified in the SOP, then default limits of 75 to 125 percent should be used.

$$\frac{(\text{Spiked Sample Result} - \text{Sample Result})}{(\text{Amount Spiked})} \times 100 = \text{Matrix Spike Recovery}$$

MATRIX SPIKE DUPLICATES: Intralaboratory split samples spiked with identical concentrations of target analyte(s). The spiking occurs prior to sample preparation and analysis. They are used to document the precision and bias of a method in a given sample matrix.

$$\frac{(|\text{MS Result} - \text{MSD Result}|) \times 100}{(\text{MS Result} + \text{MSD Result})/2} = \text{MSD RPD}$$

METHOD BLANK. The laboratory must digest and analyze a method blank with each set of samples. A minimum of one method blank is required for every 20 samples. For a running batch, a new method blank is required for each different digestion day. If no digestion step is required, then the method blank is equivalent to the reagent blank. The method blank must contain the parameter of interest at levels of less that the reporting limit for that parameter. If the method blank contains levels over the reporting limits, the samples must be redigested or redistilled and reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the method blank level. In addition, if all the samples are less than a client required limit and the method blank is also less than that limit, then the results can be reported as less than that limit.

METHOD DETECTION LIMITS (MDLS). The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. MDLs should be determined approximately once per year for frequently analyzed parameters.

REAGENT BLANK. The reagent blank is a blank that has the same matrix as the samples, i.e., all added reagents, but did not go through sample preparation procedures. The reagent blank is an indicator for contamination introduced during the analytical procedure. (Note: for methods requiring no preparation step, the reagent blank is equivalent to the method blank.) Either a reagent blank or a method blank must be analyzed with each batch of 20 samples or less. The concentration of the analyte of interest in the reagent blank must be less than the reporting limit for that analyte. If the reagent blank contains levels over the reporting limits, the samples must be reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the reagent blank level. In addition, if all the samples are less than a client required limit and the reagent blank is also less than that limit, then the results can be reported as less than that limit.

REAGENT GRADE. Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

REAGENT WATER. Water that has been generated by any method which would achieve the performance specifications for ASTM Type II water. For organic analyses, see the definition of organic-free reagent water.

5.0 HEALTH & SAFETY

5.1 The analyst must follow normal safety procedures as outlined in the Accutest Health and Safety Plan and Personal Protection Policy, which include the use of safety glasses and lab coats. In addition, all acids are corrosive and mustd be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical must be treated as a potential health hazard. Exposure to these reagents should be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe

handling of the chemicals specified in this method. A reference file of data handling sheets must be made available to all personnel involved in these analyses.

6.0 PRESERVATION & HOLDING TIME

6.1 Non-aqueous samples should be refrigerated at the time of receipt.

6.2 All samples should be digested and analyzed within 6 months of the time of collection.

7.0 INTERFERENCES

7.1 Sludge and soil samples can contain diverse matrix types, which may contain a variety of interferences. Spiked samples can be used to determine if these interferences are adequately treated in the digestion process. For a discussion of other interferences, refer to specific analytical methods.

8.0 APPARATUS

8.1 The apparatus needed for this digestion procedure are listed below. It should be noted that hot plates and beakers with watch glasses might be used in place of the digestion block and digestion tubes.

8.2 Digestion block. Temperature adjustable and designed to hold sample digestion tubes and capable of maintaining temperatures from 90 to 95°C.

8.3 Thermometers, calibrated with NIST traceable thermometers. To be used to monitor digestion temperatures.

8.4 Sample digestion tubes and ribbed watch glasses.

8.5 Automatic pipeter bottles.

8.6 100 ml volumetric flasks.

8.7 Glass funnels.

8.8 Whatman #41 filter paper.

8.9 Top loader balance.

8.10 Volumetric Pipets, class A.

8.11 Disposable Wood Spatulas

8.12 Ceramic Mixing Bowl.

9.0 REAGENTS

9.1 All chemicals listed below are reagent grade unless otherwise specified. Deionized water should be used whenever water is required.

9.2 Hydrochloric acid. Baker instra-analyzed or equivalent.

9.3 Nitric Acid. Baker instra-analyzed or equivalent.

9.4 Hydrogen Peroxide, 30 %.

9.5 Metals Spiking Solutions. All metals spiking solutions should be made up in a solution of 2 % nitric acid as described in Table 1. Use volumetric glassware and pipets or autopipets. Check with the metals supervisor for additional information. Different levels of spiking solutions may be used as specified by the area supervisor.

9.5.1 The expiration date for the spiking solution is defined as the earliest date of any element or compound in that solution.

9.6 Teflon Chips

10.0 PROCEDURE

10.1 Weigh out an amount of wet sample equivalent to 1 g of dry sample into a numbered digestion tube. The sample should be weighed out using a top loader balance and the weights should be recorded to two places past the decimal. Make sure that the sample identification is accurately recorded with the digestion tube numbers on the sample digestion log.

10.1.1 Make sure that the sample has been thoroughly mixed before weighing out the representative sample. Discard rocks, sticks, etc. from the sample. (Refer to the SOP EQA042 for proper sample aliquoting procedures). All homogenization and sample handling should be done with wooden spatulas and ceramic (or other non-metal) bowls.

10.1.2 If the sample has a low percent solids, a larger sample size may be used to obtain a weight approximately equivalent to 1 g of dry sample. Check with the metals supervisor for additional direction with sampled with low percent solids or unusual matrices.

10.1.3 If the sample is a wipe, weighing is not necessary. Transfer the entire wipe into the labeled digestion tube and proceed with the digestion following steps 10.2 through 10.10. Extra wipes must be supplied by the client for the matrix spike or duplicate.

10.2 In addition to the samples, a spike blank or a lab control and a method blank must be set up with each batch of 20 samples or less. A matrix spike, a matrix spike duplicate or a duplicate should be set up with each batch of 20 samples. Matrix spike duplicates are normally used unless otherwise specified by client requirements. Refer to Table 1 for spiking levels to use for each MS and Spike Blank.

10.2.1 For the method blank and spike blank, instead of weighing out soil add approximately 1 g of Teflong chips to the digestion tube. Add the spiking solution to the blank spike after the chips are in the tube.

10.2.2 For some clients, a solid lab control is required rather than a blank spike. In that case, the solid lab control must be weighed out in the same manner as a sample.

10.2.3 For the matrix spike and matrix spike duplicate, refer to the metals spiking SOP, EMP202, for information on the preparation and amount of spiking solution require to be added to the sample in the digestion tube.

10.2.4 For the matrix spike and matrix spike duplicate, refer to the metals spiking SOP, EMP 202, for information on the preparation and amount of "odd metals spike" is to be added to the sample in the digest tube when necessary.

10.2.5 For additional details on spiking solutions and preparation, refer to the metals spiking sop, EMP202.

10.3 Add 10 ml of 1:1 nitric acid to all Quality Control and samples.

10.4 Place the numbered tubes into a digestion block and cover with watch glasses. (If using beakers, cover the beakers with watch glasses and place them on a hot plate.) Heat the samples at 90 to 95°C until they come to a gentle reflux and then continue to heat the samples for an additional 10 to 15 minutes. Do not allow the samples to boil. After the heating is complete, allow the samples to cool.

10.5 Add an additional 5ml of concentrated nitric acid to all quality control and samples. Heat the samples at a gentle reflux for an additional 30 minutes. Do not allow the volume to be reduced to below 5 ml. Cool.

10.5.1 If brown fumes are generated during this digestion, add an additional 5ml aliquot of concentrated nitric acid and heat for 30 more minutes. Repeat this process until no more brown fumes are generated.

10.6 Continue the digestion at 90 to 95°C until the volume is reduced to 5 ml or for a period of 2 hours. Do not let the samples boil at any point during the digestion process.

10.7 Add 2 ml of water and 3 ml of 30 % hydrogen peroxide to each sample and reflux until the effervescence subsides. Cool.

10.7.1 The 30% hydrogen peroxide may be added in smaller or larger initial aliquots depending on the sample characteristics. If sample effervescence is suspected to be a problem, smaller aliquots should be used.

10.8 Continue to add 30 % hydrogen peroxide in 1ml aliquots with warming until the effervescence is minimal or until the general sample appearance is unchanged. NOTE: Do not add more than a total of 10 ml of 30 % hydrogen peroxide. Continue the digestion at 90 to 95°C until the volume is reduced to 5 ml or for a period of 2 hours.

10.9 Add 10 ml of concentrated HCl and reflux for an additional 15 minutes.

10.9.1 HCl may be omitted for some ICP-MS digestions for limited elements (As, Be, Cd, Cr, Co, Fe, Pb, Mo, Se, and Tl) at the discretion of the area supervisor or manager. However, in normal circumstances it should be added. Refer to section 2.2.

10.10 Filter the digestate through Whatman #41 filter paper (or equivalent) into 100 ml volumetric flasks. Make sure to rinse the digestion tubes and the filter paper well with deionized water. Dilute to volume with deionized water. The sample is now ready for analysis.

10.10.1 For ICP-MS analysis, the digestate should be further diluted at the instrument before analysis (normally at least by a factor of 2 to 5) and the dilution factor should be added to the instrument file.

11.0 QUALITY ASSURANCE

11.1 For each digestion batch of 20 samples or less, a lab control or a spike blank and a method blank should be prepared. Besides a lab control, a spike blank is also digested when analyzing the odd elements, such as B, Si, Sr, Sn and Pd.

11.1.1 Solid lab controls are required for some clients. Check with the metals supervisor for additional information.

11.2 For every 20 samples, a matrix spike, a matrix spike duplicate or a duplicate should be prepared. Matrix spike duplicates are normally used unless otherwise specified by the client requirements.

11.3 If a batch is a running batch, samples can be added to the batch (along with a method blank and spike blank or lab control) up to a maximum of 2 weeks.

11.3.1 Running batches are not allowed for all clients. Check with the metals supervisor for additional information.

11.4 Refer to the analytical methods SOPs for additional information on method quality control.

12.0 DOCUMENTATION

12.1 All digestion information should be entered on a digestion log. The information required includes the sample identification, the initial sample weight, the final sample volume, the acids used (including both amount and lot number), the spikes used, and the digestion times, temperatures, and the thermometer identification. Both the corrected and uncorrected temperature must be recorded.

12.2 The analyst should write additional information such as unusual sample characteristics in the Comments section. All spiking solution information should be entered in the metals spiking solution notebook.

12.3 Any corrections to laboratory data must be done using a single line through the error. The initials of the person and date of correction must appear next to the correction.

12.4 Certificates of analysis for all primary stocks must be kept on file. If a certificate is received in the lab, give the original to the area supervisor for submission for filing with the QA department.

13.0 DATA REVIEW & REPORTING

13.1 The prep analyst is responsible for updating the samples to SCH status in the LIMS system and for entering the prep information into the LIMS. This may be done manually or electronically. When the prep information is in the LIMS, the completed paperwork should be turned into the metals supervisor for review.

13.2 The supervisor or a metals analyst reviews the preparation information and approves the data in the LIMS system.

13.3 The original paperwork is submitted to the report generation department for filing.

13.4 Supervisory (or peer) personnel will review and sign all reagent documentation a minimum of once per month.

14.0 POLLUTION PREVENTION & WASTE MANAGEMENT

14.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 14.2.

14.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, EHS004. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:

14.2.2 Non hazardous aqueous wastes.

14.2.3 Hazardous aqueous wastes.

14.2.4 Chlorinated organic solvents.

14.2.5 Non-chlorinated organic solvents.

14.2.6 Hazardous solid wastes.

14.2.7 Non-hazardous solid wastes.

15.0 ADDITIONAL REFERENCES

15.1 Refer to the ICP and ICPMS analytical SOP's and the spiking procedure SOP (EMP202).

TABLE 1: SOIL SPIKING SOLUTION FOR 6010B (1.0 g sample)

Spiking Solution	Element	Stock Conc. in mg/l	Vol. of Stock in ml	Final Vol. of Spiking Solution in ml	Spiking Solution Conc. in mg/l	Amt of spike added in ml	Final Digestate Vol. in ml	Final Conc. at the instrument in mg/l
Mixed ICP Metals	Al	200.00	NA	NA	200.00	2.00	100.00	4.00 +
	Sb	50.00			50.00			1.00
	As	200.00			200.00			4.00
	Ba	200.00			200.00			4.00
	Be	5.00			5.00			0.10
	Cd	5.00			5.00			0.10
	Cr	20.00			20.00			0.40
	Co	50.00			50.00			1.00
	Cu	25.00			25.00			0.50
	Fe	100.00			100.00			2.00 +
	Pb	50.00			50.00			1.00
	Mn	50.00			50.00			1.00
	Ni	50.00			50.00			1.00
	Se	200.00			200.00			4.00
	Ag	5.00			5.00			0.10
	Tl	200.00			200.00			4.00
	V	50.00			50.00			1.00
	Zn	50.00			50.00			1.00
Soil Mineral Mix	Al	10000.00	50.00	200.00	2500.00	2.00	100.00	50.00 +
	Fe	10000.00	50.00	200.00	2500.00			50.00 +
	Ca	10000.00	12.50	200.00	625.00			12.50
	Mg	10000.00	12.50	200.00	625.00			12.50
	K	10000.00	12.50	200.00	625.00			12.50
	Na	10000.00	12.50	200.00	625.00			12.50
Odd Metals	B	1000.00	20.00	200.00	100.00	1.00	100.00	1.00
	Mo	1000.00	20.00	200.00	100.00			1.00
	Sn	1000.00	20.00	200.00	100.00			1.00
	Sr	1000.00	20.00	200.00	100.00			1.00
	Ti	1000.00	20.00	200.00	100.00			1.00
	Pd	1000.00	20.00	200.00	100.00			1.00
	Si	1000.00	40.00	200.00	200.00			2.00
	W	1000.00						

ACCUTEST LABORATORIES
STANDARD OPERATING PROCEDURE

Lab Manager:_____

QA Manager:_____

Effective Date: _____

TITLE: TOTAL ORGANIC CARBON IN SOILS SAMPLES

METHOD REFERENCES: "Procedures for Handling and Chemical Analysis of Sediment and Water Samples" prepared for the US EPA Corps of Engineers, May 1981, modified, and SW846 Method 9060, September 1986, modified, and EPA Region 2 Lloyd Kahn Method, July 1988.

Revised Sections: ***8.1, 10.2 (all), 4.0 Definition of MDL***

1.0 SCOPE AND APPLICATION

1.1 This method can be used to determine total organic carbon in any solid matrix. It may also be used for liquid matrices containing a high level of total organic carbon. Samples that are primarily aqueous may also be analyzed using this method, but sample sizes should be limited to $\leq$ 0.10 g.

1.2 The product code for total organic carbon is TOC for the Corp. of Engineers methods and for the modified SW846 9060 method. The product code is TOCLK for total organic carbon run by the Lloyd Kahn EPA Region 2 method.

2.0 SUMMARY OF METHOD

2.1 Total organic carbon is determined by combusting an acidified sample and quantitating the carbon dioxide released using infrared analysis. The quantitation is done by comparison to a linear calibration curve.

3.0 REPORTING LIMIT AND METHOD DETECTION LIMIT

3.1 The normal reporting limit for TOC in soils is 1000 mg/kg. This is based on a 0.1 g sample size. A minimum reporting limit of 100 mg/kg can be obtained by using a 1.0 g sample size. A reporting limit of 100 mg/kg is required for samples being analyzed for Lloyd Kahn TOC. A low level calibration standard is run at the level of this reporting limit.

3.2 Method Detection Limit. Experimentally determine MDLs using the procedure specified in 40 CFR, Part 136, Appendix B. This value represents the lowest reportable concentration of an individual compound that meets the method qualitative identification criteria. Experimental MDLs must be determined annually for this method.

4.0 DEFINITIONS

BATCH: A group of samples which behave similarly with respect to the sampling or the testing procedures being employed and which are processed as a unit. For QC purposes, if the number of samples in a group is greater than 20, then each group of 20 samples or less will all be handled as a separate batch.

CALIBRATION CHECK STANDARD. The calibration check standard is a mid-range calibration standard. It is recommended that the calibration check standard be run at a frequency of approximately 10 percent. (For some methods this is mandatory and for some it is a recommendation only. Refer to individual method SOP's) For most methods, the mid-level calibration check standard criteria is ± 10 percent of the true value.

EXTERNAL CHECK STANDARD. The external check standard is a standard from a separate source than the calibration curve that is used to verify the accuracy of the calibration standards. An external check must be run a minimum of once per quarter for all analyses where a check is commercially available. The laboratory should initially assess laboratory performance of a check standard using the control limits generated by the external check supplier or limits defined in the SOP. If the external check is outside of the control limits for a given parameter, all samples must be reanalyzed for that parameter after the problem has been resolved.

SPIKE BLANK SAMPLE. Digest and analyze a high and a low standard with each batch of samples. These standards must have a recovery of 90 to 110 %. If the spike blank is outside of the control limits for a parameter, all samples must be redistilled and reanalyzed for that parameter. The exception is if the spike blank recovery is high and the results of the samples to be reported are less than the reporting limit. In that case, the sample results can be reported with no flag.

LAB CONTROL SAMPLE. A solid lab control sample from an external source may be distilled with a batch, depending on individual client requirements. The solid lab control is evaluated using manufacturer's limits. If the lab control is outside of the control limits for a parameter, all samples must be redistilled and reanalyzed for that parameter. The exception is if the lab control recovery is high and the results of the samples to be reported are less than the reporting limit. In that case, the sample results can be reported with no flag.

MATRIX: The component or substrate (e.g., water, soil) which contains the analyte of interest.

MATRIX DUPLICATE: A duplicate sample is digested at a minimum of 1 in 20 samples. The relative percent difference (RPD) between the duplicate and the sample should be assessed. The duplicate RPD is calculated as shown below. Assess laboratory performance against the control limits that are specified in the SOP. In house limits are generated once sufficient duplicate data is available to generate limits (usually a minimum of 20 to 30 analyses). If a duplicate is out of control, flag the results with the appropriate footnote. If the sample and the duplicate are less than 5 times the reporting limits and are within a range of ± the reporting limit, then the duplicate is considered to be in control. Note: If control limits are not specified in the SOP, use default limits of ± 20% RPD.

$$\frac{(|\text{Sample Result} - \text{Duplicate Result}|) \times 100}{(\text{Sample Result} + \text{Duplicate Result})/2} = \text{Duplicate RPD}$$

MATRIX SPIKE: The laboratory must add a known amount of each analyte to a minimum of 1 in 20 samples. The matrix spike recovery is calculated as shown below. Assess laboratory performance against the control limits that are specified in the SOP. If a matrix spike is out of control, then the results should be flagged with the appropriate footnote. If the matrix spike amount is less than one fourth of the sample amount, then the sample cannot be assessed against the control limits and should be footnoted to that effect. Note: If control limits are not specified in the SOP, then default limits of 75 to 125 percent should be used.

(Spiked Sample Result - Sample Result) x 100 = Matrix Spike Recovery
(Amount Spiked)

METHOD BLANK. The laboratory must digest and analyze a method blank with each set of samples. A minimum of one method blank is required for every 20 samples. For a running batch, a new method blank is required for each different digestion day. If no digestion step is required, then the method blank is equivalent to the reagent blank. The method blank must contain the parameter of interest at levels of less that the reporting limit for that parameter. If the method blank contains levels over the reporting limits, the samples must be redigested or redistilled and reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the method blank level. In addition, if all the samples are less than a client required limit and the method blank is also less than that limit, then the results can be reported as less than that limit.

METHOD DETECTION LIMIT (MDL) The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. MDLs should be determined approximately once per year for frequently analyzed parameters.

REAGENT BLANK: The reagent blank is a blank that has the same matrix as the samples, i.e., all added reagents, but did not go through sample preparation procedures. The reagent blank is an indicator for contamination introduced during the analytical procedure. (Note: for methods requiring no preparation step, the reagent blank is equivalent to the method blank.) Either a reagent blank or a method blank must be analyzed with each batch of 20 samples or less. The concentration of the analyte of interest in the reagent blank must be less than the reporting limit for that analyte. If the reagent blank contains levels over the reporting limits, the samples must be reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the reagent blank level. In addition, if all the samples are less than a client required limit and the reagent blank is also less than that limit, then the results can be reported as less than that limit.

REAGENT GRADE: Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

REAGENT WATER: Water that has been generated by any method which would achieve the performance specifications for ASTM Type II water. For organic analyses, see the definition of organic-free reagent water.

REFERENCE MATERIAL: A material containing known quantities of target analytes in solution or in a homogeneous matrix. It is used to document the bias of the analytical process.

STANDARD CURVE: A plot of concentrations of known analyte standards versus the instrument response to the analyte. Calibration standards are prepared by successively diluting a standard solution to produce working standards which cover the working range of the instrument. Standards should be prepared at the frequency specified in the appropriate section. The calibration standards should be prepared using the same type of acid or solvent and at the same concentration as will result in the samples following sample preparation. This is applicable to organic and inorganic chemical analyses.

5.0 HEALTH & SAFETY

5.1 The analyst must follow normal safety procedures as outlined in the Accutest Laboratory Safety Manual which includes the use of safety glasses and lab coats. In addition, all acids are corrosive and must be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

5.2 The furnace operates at high temperature and the furnace should be allowed to cool down before doing any system maintenance or troubleshooting. If there are any signs of a system blockage, open the sample introduction port and turn off the furnace to prevent build up of back pressure.

5.3 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical should be treated as a potential health hazard. Exposure to these reagents should be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets must be made available to all personnel involved in these analyses.

6.0 PRESERVATION & HOLDING TIME

6.1 Soil samples should be kept under refrigeration at 4^0 C until they are analyzed.

6.2 No holding time is outlined in the Corp. of Engineers method for TOC. SW846 9060 specifies a holding time of 28 days for aqueous samples. Unless otherwise specified, this 28-day holding time will also be applied to solid samples analyzed using this SOP.

6.3 A 14 day holding time should be followed when analyzing TOC soils following the EPA Region II Lloyd Kahn method.

7.0 INTERFERENCES

7.1 High results may be obtained if the inorganic carbon is not completely removed from the sample before analysis. To ensure that all of the inorganic carbon is removed, heat an acidified sample at least 10 minutes at 75°C before starting the analysis. Some volatile organics may be lost in this heating step, resulting in a low bias in the TOC result.

8.0 APPARATUS

The following items are needed for the analysis of samples following the method outlined below:

8.1 Shimadzu 5000 TOC analyzer or TOC-V analyzer with soil analysis module or equivalent.

8.1.1 Each day of analysis, the humidifier should be checked to ensure that the water level is within 1 inch of the top of the humidifier.

8.1.2 Each day of analysis, the baseline should be checked to make sure that it is stable and near zero.

8.1.3 Whenever calibration check recoveries or blanks are out of compliance, the flow and the condition of the catalyst should be checked. If the catalyst appears bad (contains many small fines), it should be cleaned and replaced. Refer to the instrument manuals for additional information on system maintenance.

8.2 Syringes, 0.100 ml size.

8.3 Analytical balance, capable or weighing to 0.1 mg. The calibration of the analytical balance should be verified each day before use.

8.4 Volumetric glassware, class A, for standards preparation.

8.5 Ceramic boats.

8.6 Drying oven, capable of being set to 75°C

9.0 REAGENTS

All chemicals listed below are reagent grade unless otherwise specified. Deionized water taken from the DI tap with the carbon filter should be used whenever water is required. Make sure to properly label all reagents and record the reagent preparation in the reagent logbook.

9.1 Sucrose Stock Solution, 200000 mgC/l (20% C from sucrose): Dry sucrose in dissector. Weigh out 47.5 grams into a 100 ml volumetric flask containing approximately 80 ml of DI water. Add concentrated hydrochloric acid to bring the pH to less than 2. Mix well and bring to a final volume of 100 ml. Note: This stock should be replaced whenever crystallization of the sucrose is apparent. It can be held for a maximum of 3 months. Refrigeration is not required.

9.2 Sucrose Standard Solutions: Dilute the above stock solution (200000 mC/l) as shown below to make the suggested calibration standards. Add concentrated hydrochloric acid to bring the pH to less than 2 before diluting each standard to the final volume.

9.2.1 Different standards may be used, but a minimum of 5 standards and a blank are required for the initial calibration. The top standards shown below are close to the top of the linear range of the instrument and sometimes will not work at these levels.

9.2.2 Two suggested curve levels are shown below. These standards must be held for no longer than one month.

9.2.3 High curve. Either the 50000 mgC/l or the 40000 mgC/l may be used as the highest standard. Both are not required.

Standard Level	ml of stock	Final volume (ml)
50000 mgC/l	25.0	100
40000 mgC/l	20.0	100
25000 mgC/l	12.5	100
10000 mgC/l	10.0	200

5000 mgC/l	5.00	200
1000 mgC/l	1.00	200
Blank	0.000	100

9.2.4 Lower curve.

Standard Level	ml of stock	Final volume (ml)
25000 mgC/l	12.5	100
20000 mgC/l	10.0	100
10000 mgC/l	10.0	200
5000 mgC/l	5.00	200
1000 mgC/l	1.00	200
Blank	0.000	100

9.3 Glucose Stock solution, 50000 mgC/l (5% C from glucose): Dry glucose in dessicator. Weigh out 12.5 grams into a 100 ml volumetric flask containing approximately 80 ml of DI water. Add concentrated hydrochloric acid to bring the pH to less than 2. Mix well and bring to a final volume of 100 ml. Note: This stock should be replaced whenever crystallization of the glucose is apparent. It can be held for a maximum of 1 month. Refrigeration is not required.

9.4 Glucose Check Solution, 25000 mgC/l (2.5% C from glucose): Dilute 50.00 ml of the glucose stock solution (50000 mC/l) to approximately 80 ml with DI water. Add concentrated hydrochloric acid to bring the pH to less than 2 and then dilute to a final volume of 100 ml with DI water. This solution should be made up monthly.

9.4.1 A different concentration of this check solution will be needed if a lower curve is run.

9.4.2 This is from a separate source than the calibration curve and can be used as the ICV check.

9.5 Nitric Acid, reagent grade. Used for acidifying samples to remove inorganic carbon.

9.5.1 Dohrman Instruments recommends that phosphoric acid not be used for this purpose. Dohrman found that the phosphoric acid tended to coat both the boat and the catalyst in the furnace with a layer of polyphosphoric acid and that, possibly as a consequence of this, the release of inorganic carbon as carbon dioxide was slower than with nitric acid and possibly incomplete.

9.6 Oxygen Gas, high purity.

9.7 Pre-baked cat litter or silica sand.

10.0 PROCEDURE

10.1 Below is the procedure to be followed for the analysis of soil samples for total organic carbon using the Shimadzu TOC soil analyzer. For the procedure with the newer Shimadzu TOC-V soil analyzer, refer to step 10.2. (More details for use of the software can be found in the TOC-V CPH/CPN users manual.)

10.1.1 Turn on the oxygen. The pressure in the soil module should be set at 2 and the carrier gas should be set as marked on the dial (0.5 l/min). The oxygen pressure at the tank must be at least 60 psi to maintain sufficient pressure at the instrument. Check to make sure that the humidifier contains sufficient water. It should be filled to within approximately 1 inch of the top of the humidifier. (The humidifier is located under the magnetic plate on the right side of the instrument.)

10.1.2 If the power is off, then turn on the power at the side of the soil and water modules and for the computer.

10.1.3 Go into the TOC software on the TOC. Select measure and then connect. Wait for the software to connect with the TOC analyzer. Proceed to options and then instrument conditions. Under TOC, there should be no check next to Furnace on. Under ASI, there should be no check next to ASI used. Under SSM, the TOC furnace should be turned on.

10.1.4 Go to view and click on the background monitor. A graph will appear on screen showing the position of the baseline and the status of the furnace temperature. Wait for the baseline to stabilize and for the furnace temperature to indicate that it is OK. Make sure that the hatch on the boat sampler is tightly closed and that there are no leaks in the system. If the baseline is not within $\pm$ 10 of zero, then the zero of the instrument may need to be adjusted. Check with the lab supervisor or manager for further instructions.

10.1.5 If the instrument has not been calibrated within the last month, then it is recommended that it be calibrated at this point. (A new calibration is required at least once per quarter.)

10.1.5.1 Select a new file and insert standards. A minimum of 2 injections must be used for each standard. Five standards and a blank are required for the calibration. The lowest standard should be at 1000 mgC/l or lower. A 100 ul injection size should be used for all standards.

10.1.5.2 After the standard file is created and inserted into the run file, then save the run file using the save as command. The file should be named with the instrument ID (A or B), the last digit of the year, the month, the day, and a designation for the matrix and the run number for that matrix. For example, the first soil run on instrument A from 3/28/01 would be named A10328s1.

10.1.5.3 Press start in the software and follow the prompts. Place a clean boat filled with a small tuft of glass wool in the boat sampler. When indicated by the software, inject 100 ul of standard into the boat. Close the hatch and push the boat all the way forward. Enter OK at the software.

10.1.5.4 After the sample has finished running, the software will prompt you to pull the boat back to the cool position. Pull the boat only to the cool line at this point. When indicated by the software, then pull the boat back to the starting position.

10.1.5.5 Select the option to repeat the injection and repeat the steps outlined above.

10.1.5.6 When all of the standards have been completed, then review the curve using the view, calibration option.

10.1.5.6.1 If a correlation coefficient of greater than 0.995 is obtained, then save the curve using the file, save option. Check to make sure that the intercept, calculated using a weight of 1.0 g for Lloyd Kahn or using a weight of 0.1 g for other TOC analyses, is less than the reporting limit for each method (100 mg/kg for Lloyd Kahn or 1000 mg/kg for other TOC soils.)

10.1.5.6.2 If either the correlation coefficient or the intercept does not meet the above criteria, than recalibrate before proceeding with the samples.

10.1.5.7 If a previous calibration is being used, then it must be verified with a low and a high standard and a blank before proceeding on each analysis day. The low standard must be within 30 percent of the true value. All other check standards must be within 10 percent of the true value. The blank must contain less than the reporting limit for TOC. Make sure to use duplicate injections for all analyses. Note: The method blank may be used as the calibration blank check.

10.2 Below is the procedure to be followed for the analysis of soil samples for total organic carbon using the Shimadzu TOC-V soil analyzer.

10.2.1 Turn on the oxygen. The pressure in the water module should be set at 200 Kpa and the carrier gas should be set as marked on the dial (150 ml/min). The oxygen pressure at the tank must be at least 60 psi to maintain sufficient pressure at the instrument. Check to make sure that the humidifier contains sufficient water. It should be filled to within the two white lines on the side of the humidifier. (The humidifier is located inside the water analyzer at the right side of the instrument.)

10.2.2 If the power is off, then turn on the power at the side of the soil modules and at the bottom right of the front panel of the water moldule and for the computer.

10.2.3 Go into the TOC software on the TOC. In the TOC-Control V main window, double click on the sample table editor and click OK on the user name box.

10.2.4 Before starting the run, open the background monitor to make sure that the baseline is stable and the furnace is up to temperature. If there are problems at this point, check with the lab supervisor or manager for further instructions.

10.2.5 Click File, New, and choose Calibration Curve and click OK. Follow the directions on each screen. For the system, pick TOC-V with SSM. Click on the calibration points. Then enter the file name. The file should be named with the instrument identifier (A or B or C), year (1 digit), the month (2 digits), the day, and a designation for the matrix and the run number for that matrix. For example, the first soil run on

instrument C from 3/12/07 would be named A70312s1. Enter the file name and then go to the volume. Enter the concentration and number of points. Edit the points to correct the concentrations. Enter next until the last screen is reached and then click on finish.

10.2.5.1 If using a previously generated calibration, then this step can be omitted. A new calibration is required at least once per quarter, but it is recommended that this be run once per month.

10.2.6 Go back to the TOC-Control V main window and double click the sample table editor. Click File and New to open the sample run icon. Click the system tab and select the TOC-SSM system. Click on the new file and follow the prompts on the screen. Name the file using the convention as described above.

10.2.7 Connect to the instrument using the connect toolbar button or from the instrument menu. Insert the calibration file created above into the sample table. You must load the new curve into the method before running the samples.

10.2.8 To start running the calibration, press start in the software and follow the prompts. Place a clean boat filled with a small tuft of glass wool in the boat sampler. When indicated by the software, inject 100 ul of standard into the boat. Close the hatch. Enter 100 ul into the volume prompt and then hit start. Wait for the prompt and then push the boat forward.

10.2.9 After the sample has finished running, the software will prompt you to pull the boat back to the cool position. Pull the boat only to the cool line at this point. When indicated by the software, then pull the boat back to the starting position.

10.2.10 When all of the standards have been completed, then review the curve using the view, calibration option. If a correlation coefficient of greater than 0.995 is obtained and the intercept is less than the RDL, then save the curve and put it into the method(s) that you are running. Then you can proceed to add samples.

10.6 After the calibration or calibration checks are completed, then analyze the external check standard made from glucose. This standard must agree within 10 percent of the true value. If it is not within this range, determine the source of the problem before proceeding. Note: The spike blank may be used as the external calibration check, but then the results must be within 10 percent of the true value.

10.7 After every 10 samples, a continuing calibration check (CCV) sample must be analyzed. The continuing calibration check should be a standard near the mid-range of the curve. The continuing calibration check should agree within 10 percent of the true value. If the CCV is not within 10% of the true value, then no samples can be reported in the area bracketed by this CCV unless the CCV is biased high (110 to 150%) and the sample results to be reported are less than the reporting limit.

10.8 For some clients, a continuing calibration blank (CCB) may be required. This is not required as part of the normal TOC protocol. If it is required, than it should be run after each CCV check. The results of the CCB must be less than the reporting limit for TOC. If the CCB is

not less than the reporting limit, then no samples can be reported in the area bracketed by this CCB unless the samples results to be reported are less than the reporting limit.

10.9 Begin analyzing the samples following the procedure outlined below.

10.10.1 Weigh out from 100 to 1000 mg of sample (wet weight) into a ceramic boat using a 4-place analytical balance. For samples that contain high levels of TOC smaller sample sizes may be needed. For unknown samples, start with a sample size of 100 mg. (All method blanks and spike blanks should be calculated assuming a 100 mg sample size and should be set up using silica sand or pre-baked cat litter.) Samples that contain non-homogeneous particulates should be homogenized with a mortar and pestle before weighing out the sample aliquot.

10.10.1.1 If a client is requiring a detection limit lower than 1000 mg/kg, then larger sample sizes are required. A detection limit of 100 mg/kg requires a weight of 1 gram. A smaller sample size may be used only to bring the sample to within the range of the calibration curve.

10.10.1.2 If less than 50 mg is used for a sample to bring it within linear range, then 4 replicates must be analyzed at that weight.

10.10.2 Add nitric acid dropwise to the sample until no additional effervescence is observed and the surface of the sample is covered with the acid. Heat the acidified sample in an oven at 75°C for a minimum of 10 minutes.

10.10.3 If the duplicate sample injections have a coefficient of variation (CV) of greater than15 percent or an RPD of greater than 20%, then repeat the analysis with 2 additional duplicate injections. If, on the repeated analysis, a high CV or RPD is still obtained, then the sample results should be reported with a flag due to possible sample non-homogeneity. This 15% CV or 20% RPD criteria does not apply if the sample results are low and the results are within plus or minus the reporting limit of each other.

$$CV = (\text{Std Dev}_{n-1} / \text{mean}) \times 100$$

$$RPD = (\text{Result1} - \text{Result 2})) \times 100/\text{mean}$$

10.10.4 With each batch of 20 samples or less, a matrix spike and a duplicate should be analyzed. On each analysis day, a method blank and spike blank must be analyzed. All of these quality control points must be analyzed in duplicate.

10.10.4.1 Prepare the method blank by treating a small amount (approximately 100 mg) of pre-baked cat litter or silica sand with nitric acid and heating at 75 ° C for a minimum of 10 minutes.

10.10.4.2 Prepare the spike blank in the same manner as the method blank, but spike it with 100 ul of a 20000 mgC/l standard or external solution before adding the acid. Note: The spike blank can be used in place of the external check, but then must be prepared from the external source and must meet the 10 % check criterion.

10.10.4.3 Prepare the duplicate in the same manner as a sample.

10.10.4.4 Prepare the matrix spike by adding 100 ul of a 20000 mgC/l standard or external solution to a sample aliquot before adding the acid and heating the sample.

10.10.5 At the end of the analysis, a continuing calibration check must be analyzed. If the calibration check is not within 10 percent of the true value then all samples bracketed by the out of compliance CCV must be reanalyzed. (If the CCV is within 110 to 150%, then samples with results <RDL may be reported.)

10.10.6 If required, a CCB should be analyzed after the final CCV check of the analysis. Refer to Section 10.9.

10.11 The final sample results are calculated using the equation shown below. The calculation is done automatically in the Shimadzu TOC software except for the percent solids correction. The percent solids correction is added when the data is transferred in the LIMS system. See area supervisor or manager for further details.

Organic Carbon, Total (mg/kg) =

$$\frac{\text{Conc. from curve (ug)}}{\text{sample weight in g x \%sol/100}}$$

11.0 QUALITY CONTROL

Below is a summary of the quality control requirements for this method. Make sure to check with the laboratory supervisor or manager for any additional client specific quality control requirements.

11.1 Method Detection Limits (MDLs). MDLs should be established using a blank sample spiked at approximately 3 times the estimated detection limit. To determine the MDL values, take seven replicate aliquots of the spiked sample and process through the entire analytical method. The MDL is calculated by multiplying the standard deviation of the replicate analyses by 3.14, which is the student's t value for a 99% confidence level. MDLs should be determined approximately once per year.

11.2 Calibration Curve. The instrument must be calibrated a minimum of once per quarter. It is recommended that the instrument be calibrated at least once per month. The calibration curve must have a correlation coefficient of at least 0.995 and the intercept must be less than the reporting limit. If the instrument is not calibrated on a given day, then the curve must be verified using a low and a high standard and a blank before proceeding on each analysis day. The low standard must be within 30 percent of the true value. All other check standards must be within 10 percent of the true value. The blank must contain less than the reporting limit for TOC.

11.3 Method Blank. The laboratory must prepare and analyze a method blank with each set of samples. A minimum of one method blank is required for every 20 samples. For a running batch, a new method blank is required for each different analysis day. The method blank must contain the analyte at less that the reporting limit. If the method blank contains over that

limit, the samples must reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the method blank level. In addition, if all the samples are less than a client required limit and the method blank is also less than that limit, then the results can be reported as less than that limit.

11.4 Spike Blank. The laboratory must prepare and analyze a spike blank with each set of 20 or less samples. For a running batch, a new spike blank is required for each different analysis day. The laboratory should assess laboratory performance of the spike blank against recovery limits of 80 to 120 percent. (If the spike blank is used in place of the external, then it must be within recovery limits of 90 to 110 percent.) If the lab control recovery is high and the results of the samples to be reported are less than the reporting limit, then the sample results can be reported with no flag. In all other situations, all samples associated with a spike blank outside of recovery limits must be reanalyzed.

11.5 Matrix Spike. The laboratory must add a known amount of each analyte to a minimum of 1 in 20 samples. (Note: For Florida samples, spikes should be prepared for 1 in 10 samples.)

11.5.1 The spike recovery should be assessed using in house limits. Until these limits can be generated, then default limits of 75 to 125 percent recovery should be applied. If a matrix spike is out of control, then the results should be flagged with the appropriate footnote. If the matrix spike amount is less than one fourth of the sample amount, then the sample cannot be assessed against the control limits and should be footnoted to that effect.

11.5.2 The matrix spike recovery should be calculated as shown below.

$$\frac{\text{(Spiked Sample Result - Sample Result)}}{\text{(Amount Spiked)}} \times 100 = \text{MS Recovery}$$

11.6 Matrix Duplicate. The laboratory must prepare and analyze a duplicate sample for a minimum of 1 in 20 samples. The relative percent difference (rpd) between the duplicate and the sample should be assessed. Matrix spike duplicates may be used in place of matrix duplicates. The duplicate rpd is calculated as shown below.

11.6.1 The duplicate RPD should be assessed using in house limits. Until these limits can be generated, then default limits of 20 percent RPD should be applied. If a duplicate is out of control, then the results should be flagged with the appropriate footnote. If the sample and the duplicate are less than 5 times the reporting limits and are within a range of $\pm$ the reporting limit, then the duplicate is considered to be in control.

11.6.2 This duplicate fills the requirement for quadruplicate injections for one sample in 20 for the TOCLK method.

11.6.3 The duplicate RPD should be calculated as shown below.

$$\frac{\text{(Sample Result - Duplicate Result)} \times 100}{\text{(Sample Result + Duplicate Result)} \times 0.5} = \%\ \text{RPD}$$

11.7 Quality Control Sample (also referred to as Initial Calibration Verification Standard, (ICV)). A standard from a separate source than the calibration should be run at the beginning of

each run. This ICV should be within 10 percent of the true value. If it is not, the problem must be resolved before any samples can be analyzed. Note: The spike blank may be used in place of the ICV as long as a separate source standard is used and the 10 percent criterion is met.

11.8 Continuing Calibration Verification (CCV). Analyze the continuing calibration verification solution after every tenth sample and at the end of the sample run. If the CCV solution is not within 10 percent of the true value, then no samples can be reported in the area bracketed by that CCV. (Note: the exception is if the CCV is biased high (111 to 150%) and the samples are less than the detection limit. In that case, the samples can be reported with no flag.) The CCV concentration should be at or near the mid-range of the calibration curve.

11.9 Continuing Calibration Blank (CCB). For some clients, a continuing calibration blank (CCB) may be required. This is not required as part of the normal TOC protocol. If it is required, than it should be run after each CCV check. The results of the CCB must be less than the reporting limit for TOC. If the CCB is not less than the reporting limit, then no samples can be reported in the area bracketed by this CCB unless the sample results to be reported are less than the reporting limit.

12.0 DOCUMENTATION REQUIREMENTS

12.1 Each analyst should review all data and assemble a data package consisting of the following information. This data package should be turned into the supervisor for review after the analysts complete their LIMS review (see 12.3 below).

- Results report, showing dilutions, replicate injection results, and CV or RPD results.
- Preparation/run log showing weights taken at the balance for each injection.
- Standards prep sheet.
- Reagent information sheet.
- QC Summary sheet with calculations

12.2 In addition, all reagent information such as lot numbers should also be recorded in the reagent log book. Any unusual characteristics of the samples should be noted on the raw data or on the preparation log. Make sure that all sample ID's and dilutions are labeled on the data.

12.3 An ASCI format file should be generated and copied over to the LIMS. The analyst is responsible for reviewing the data in the LIMS and adding appropriate spike amounts and true values before sending the data for supervisor approval.

13.0 POLLUTION PREVENTION & WASTE MANAGEMENT

13.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 13.2.

13.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, EHS004. This

document describes the proper disposal of all waste materials generated during the testing of samples as follows:

13.2.1 Non hazardous aqueous wastes.

13.2.2 Hazardous aqueous wastes

13.2.3 Chlorinated organic solvents

13.2.4 Non-chlorinated organic solvents

13.2.5 Hazardous solid wastes

13.2.6 Non-hazardous solid wastes

14.0 ADDITIONAL REFERENCES

14.1 Shimadzu Instrument Manual

ACCUTEST LABS
STANDARD OPERATING PROCEDURE

Lab Manager_____

QA Manager_____

Effective Date:_____

SOP Title: GRAIN SIZE AND SIEVE TESTING

METHOD REFERENCE: ASTM D422-63

Revised Sections: ***14.2, 14.3, 5.1, 5.2, 15.2***

1.0 SCOPE AND APPLICATION

1.1 This method is used as a quantitative determination of the distribution of particle size in soils. The distribution of particle sizes larger than 75µm (retained on the number 200 sieve) is determined by sieving, while the distribution of particle sizes smaller than 75µm is determined by a sedimentation process, using a hydrometer.

2.0 SUMMARY OF METHOD

2.1 An air-dried sample is divided into two portions; one portion is retained on a number 10 sieve and the second portion contains only particles that pass the number 10 sieve. The portion retained on the number 10 is separated into a series of fractions using as many sieves as needed depending on the sample. The portion passing the number 10 sieve is soaked in a dispersing agent for 16 hours, vigorously stirred, transferred to a sedimentation cylinder, and allowed to settle for a period of up to 24 hours with hydrometer readings taken at specific intervals.

3.0 REPORTING LIMIT AND METHOD DETECTION LIMIT

3.1 Reporting Limit. The reporting limit is not application for this method. Results are reported as a percent of the total sample weight.

3.2 Method Detection Limit. Method Detection limits studies are not required for this method.

4.0 DEFINITIONS

BATCH: A group of samples which behave similarly with respect to the sampling or the testing procedures being employed and which are processed as a unit. For QC purposes, if the number of samples in a group is greater than 20, then each group of 20 samples or less will all be handled as a separate batch.

MATRIX: The component or substrate (e.g., water, soil) which contains the analyte of interest.

MATRIX DUPLICATE: A duplicate sample is analyzed at a minimum of 1 in 20 samples. The relative percent difference (RPD) between the duplicate and the sample should be assessed. The duplicate RPD is calculated as shown below. Assess laboratory performance against the control limits that are specified in the SOP. In house limits are generated once sufficient duplicate data is

available to generate limits (usually a minimum of 20 to 30 analyses). If a duplicate is out of control, flag the results with the appropriate footnote. If the sample and the duplicate are less than 5 times the reporting limits and are within a range of ± the reporting limit, then the duplicate is considered to be in control. Note: If control limits are not specified in the SOP, use default limits of ± 20% RPD.

$$\frac{(|\text{Sample Result} - \text{Duplicate Result}|) \times 100}{(\text{Sample Result} + \text{Duplicate Result})/2} = \text{Duplicate RPD}$$

REAGENT BLANK: The reagent blank is a blank that has the same matrix as the samples, i.e., all added reagents, but did not go through sample preparation procedures. The reagent blank is an indicator for contamination introduced during the analytical procedure. (Note: for methods requiring no preparation step, the reagent blank is equivalent to the method blank.) Either a reagent blank or a method blank must be analyzed with each batch of 20 samples or less. The concentration of the analyte of interest in the reagent blank must be less than the reporting limit for that analyte. If the reagent blank contains levels over the reporting limits, the samples must be reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the reagent blank level. In addition, if all the samples are less than a client required limit and the reagent blank is also less than that limit, then the results can be reported as less than that limit.

REAGENT GRADE: Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

REAGENT WATER: Water that has been generated by any method which would achieve the performance specifications for ASTM Type II water.

5.0 HEALTH & SAFETY

5.1 The analyst must follow normal safety procedures as outlined in the Accutest Laboratory Safety Manual which includes the use of safety glasses and lab coats. In addition, all acids are corrosive and must be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical must be treated as a potential health hazard. Exposure to these reagents must be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets must be made available to all personnel involved in these analyses.

6.0 PRESERVATION & HOLDING TIME

6.1 All samples should be kept under refrigeration at 4^0 C until they are analyzed.

6.2 No specific holding time is listed in this method.

7.0 INTERFERENCES

7.1 No interferences are specified in this method.

8.0 APPARATUS

The following items are needed for the analysis of samples following the method outlined below:

8.1 Sieves, a series of sieves, of square-mesh woven wire cloth giving uniform spacing of data points for graph. The series of sieves listed below is recommended. An alternate series of sieves is also allowed in the method.

Sieve Name	Particle size
3 in	75.0 mm
1.5 in	37.5 mm
¾ in	19.0 mm
3/8 inch	9.5 mm
No. 4	4.75 mm
No. 8	2.36 mm
No. 10	2.00 mm
No. 16	1.18 mm
No. 30	0.600 mm
No. 50	0.300 mm
No. 100	0.150 mm
No. 200	0.075 mm

8.2 Four decimal place analytical balance. The balance must have its calibration verified with Class S weights

8.3 Stirring apparatus. A mechanically operated stirring device in which a suitably mounted electric motor turns a vertical shaft at a speed of not less than 10000 rom without a load. The shaft shall be equipped with a replaceable stirring paddle made of metal, plastic, or hard rubber. Humboldt model 936 stirrer or equivalent should be used in the lab.

8.4 Dispersion cup equipped with baffle rods. Humboldt model H-2465 or equivalent should be used in the lab.

8.5 Hydrometer, 152H, meeting ASTM specifications. (Hydrometer 151H may also be used as described in the method, but this SOP describes the use of hydrometer 152H.)

8.6 Sedimentation cylinder marked for a volume of 1000 ml and an inside diameter such that the 1000-ml mark is 36 ± 2 cm from the bottom on the inside.

8.7 Thermometer accurate to 1°F (0.5°C)

8.8 Timing device, watch or clock with a second hand

8.9 Beakers, at least 250-ml capacity

9.0 REAGENTS

9.1 All chemicals listed below are reagent grade unless otherwise specified. Deionized water should be used whenever water is required. Make sure to properly label all reagents and record the reagent preparation in the reagent log book. All chemicals must be low in silica.

9.2 Dispersing Agent, dissolve 40 gm of sodium metaphosphate (sometimes called sodium hexametaphosphate) in DI water with stirring and dilute to 1 liter. **NOTE:** If acidic, solutions of this salt will slowly hydrolyze back to the orthophosphate form with a decrease in dispersive action. New solutions should be made at least once a month or be adjusted to pH of 8 or 9 by means of sodium carbonate.

10.0 SAMPLE PREPARATION PROCEDURE AND SIEVE ANALYSIS

(Note – refer to Figure 1 for a summary of the steps in Sections 10 and 11.)

10.1 Weigh out a sample aliquot of approximately 100 to 200 g. Enough dried sample must be obtained to have 65 g of clay or silt or 115 g of sand that passes through the number 10 sieve. Spread the sample aliquot out evenly on a piece of aluminum foil or other clean surface. Let the sample air dry until dry in appearance. If the sample forms a crust during the drying processing, use a spatula to break up the crust and prevent water from being trapped below the crust. Mix the dried sample well.

10.2 Place an aliquot of the dried sample in the mortar and break it into small pieces with a rubber covered pestle. All clay clumps, etc. should be broken apart. Weigh out enough sample to have approximately 65 g of clay or silt sample passing through the Number 10 sieve or 115 g of sandy sample passing through the Number 10 sieve. Record the final weight.

10.3 Sieve the sample through the number 10 sieve. Shake the sieve stack laterally and vertically, accompanied by a jarring action in order to keep the sample moving continuously over the surface of the sieve. In no case turn or manipulate fragments of the sample through the sieve by hand. Continue shaking until not more than 1% of the mass remaining on the sieve passes that sieve during 1 minute of shaking. NOTE: Do not overload the sieve to the extent that the soil that would normally be retained on that sieve interferes with the soil that would normally pass through the sieve).

10.4 Pour the sample remaining on the top of the Number 10 sieve back into the mortar and use the pestle to again break up any clumps of clay or dirt.

10.5 Pour this sample back into the number 10 sieve and repeat the sieving process outlined in step 10.3.

10.6 Combine all sample going through the number 10 sieve into a separate container and save for additional sieve testing, moisture testing, and hydrometer testing as outlined below.

10.7 Take the sample remaining on the number 10 sieve and wash it with a small amount of water to remove any dust, etc. still adhering to the particulate. If insignificant dust remains on the sample, then this step may be omitted. Air dry the sample and record the final weight.

10.8 Separate the sample portion retained on the number 10 sieve into a series of fractions using as many sieves as needed depending on the sample or upon the specifications for the material being tested. The normal series of sieves used include the 3 inch sieve, the 1.5 inch

sieve, the ¾ inch sieve, the 3/8 inch sieve, the number 4 sieve, and the number 8 sieve. Follow the following protocol for each sieve.

10.8.1 Shake the sieve stack laterally and vertically, accompanied by a jarring action in order to keep the sample moving continuously over the surface of the sieve. In no case turn or manipulate fragments of the sample through the sieve by hand. Continue shaking until not more than 1% of the mass remaining on the sieve passes that sieve during 1 minute of shaking.

10.8.2 When the step 10.8.1 is complete for a given sieve, then weigh the portion of sample remaining on the sieve and record the weight.

10.9 Weigh out an aliquot of approximately 10 g of the sample portion passing through the number 10 sieve (from section 10.6) and record the weight. Dry the aliquot to constant mass at 110 ± 5°C. Constant mass is defined as a change of less than 0.01 in the hygroscopic moisture correction factor. Calculate the hygroscopic moisture correction factor by dividing the mass of the oven dried sample by the mass of the air dried sample. (This correction factor will be used to correct the remaining test material mass to determine an accurate dry mass for the sample in the hydrometer testing).

10.10 Perform the hydrometer testing as outlined in Section 11 using the air dried sample that passed through the number 10 sieve. After the hydrometer testing is complete, pour the suspended sample through a number 200 sieve and wash well with DI water. Then dry the sample in an oven at 110 ± 5°C until completely dry.

10.11 Separate the oven-dried aliquot into a series of fractions using as many sieves as needed depending on the samples or upon the specifications for the material being tested. The normal series of sieves used include the number 16 sieve, the number 30 sieve, the number 50 sieve, the number 100 sieve, and the number 200 sieve. Follow the steps outlined above in 10.8.1 and 10.8.2 for the sieving process.

10.11.1 If hydrometer testing is not performed, then oven dry the whole aliquot of sample to be used for the sieves smaller than number 10.

10.12 Calculate the percentage of sample passing through each sieve. This can be done using the calculation template or it can be calculated by hand.

10.12.1 The equation to be used to calculate the percentage of the sample passing through the number 10 or larger sieve is shown below.

% of sample passing through the sieve (number 10 and larger) =

$$\frac{100 \times (\text{tot. sample wt} - (\text{wt retained on sieve of interest} + \text{wt retained on all larger sieves}))}{\text{tot. sample wt}}$$

10.12.2 The equations to be used to calculate the percentage of the sample passing through a sieve smaller than number 10 are shown below. These calculations include a correction factor to take into account the size of the aliquot used. Note that the weight of the aliquot is the weight of sample put into the hydrometer when

hydrometer testing is done as the sample is poured through the number 200 sieve when it is first removed from the hydrometer.

A = (wt retained on sieve of interest + wt retained on all larger sieves under 10)

$$\text{Fraction of aliquot} = \frac{\text{(wt. of aliquot} - A)}{\text{wt. of aliquot}}$$

$$\%\text{ passing through sieve} = \text{Fraction of aliquot} \times \frac{\text{air dry weight passing through 10}}{\text{total air dry weight sieved}}$$

10.13 Calculate the percentage in the sample of gravel, sand, and silt, clay, and colloids. Gravel is defined as the sample passing through the 3 inch sieve and retained on the No. 4 sieve. Sand is defined as the sample passing through the No. 4 sieve and retained on the No. 200 sieve. Silt, clay, and colloids are defined as sample passing through the No. 200 sieve.

11.0 HYDROMETER ANALYSIS PROCEDURE

11.1 Determine hygroscopic moisture correction factor as described in section 10.9 above.

11.2 Determine the Composite Correction for Hydrometer – In a sedimentation cylinder, add 125 ml of the dispersing agent and dilute with DI water to 1000 ml (control sample).

11.2.1 Adjust the temperature of the control sample to 20 deg. C.(or to the lowest temperature expected during the measuring process.) Place the thermometer and the hydrometer into the control sample. Record the hydrometer and thermometer readings. Record the composite correction faction which is the difference between the hydrometer reading and zero.

11.2.1.1 The hydrometer should be read at the top of the meniscus formed on the stem.

11.2.2 Adjust the temperature of the control sample to 24 deg. C.(or to the highest temperature expected during the measuring process.) Place the thermometer and the hydrometer into the control sample. Record the hydrometer and thermometer readings. Record the composite correction faction which is the difference between the hydrometer reading and zero.

11.2.3 Use the known composite correction factors and temperatures to determine composite correction factors at different temperatures in the range tested.

11.3 When the soil is mostly clay and silt sizes, weigh out approximately 50 g of air-dried soil. When the soil is mostly sand, weigh out approximately 100 g. Record the weight used. Place the sample aliquot into a beaker and cover with 125 ml of the sodium metaphosphate solution (5.1). Stir until the soil is thoroughly wetted. Allow it to soak for at least 16 hours.

11.4 After soaking, pour the sample into the dispersion cup, making sure to wash any sediment remaining in the original sample container into the dispersion cup with deionized water. Add deionized water so that the cup is more than half full and stirr for a period of 1

minute. Immediately after dispersion, transfer the slurry to the sedimentation cylinder, making sure all of the sample is removed from the beaker by using a wash bottle. Dilute to the 1000-ml mark on the cylinder with DI water.

11.5 Using Parafilm and the palm of the hand over the open end of the cylinder (or a robber stopper), turn the cylinder upside down and back for a period of 1 minute to complete the agitation of the slurry. Any soil remaining at the bottom of the cylinder during the first few turns, should be loosened by vigorous shaking while the cylinder is in the inverted position. The number of turns should be about 30, counting the turn upside down and back as one turn.

11.6 Set the sample cylinder next to the control cylinder and take hydrometer readings for the sample and the control at the following time intervals: 2, 5, 15, 30, 60, 250 (4 hours and 10 minutes), and 1440 minutes (24 hours).

11.6.1 When it is time to take a reading, record the temperature and the uncorrected hydrometer reading of the control sample on the data sheet. Then insert the hydrometer into the soil sample cylinder at the approximate depth it will have when the reading is taken (insert hydrometer 20 to 25 seconds before scheduled reading time). Record the uncorrected hydrometer reading for the sample on data sheet. The hydrometer should be read at the top of the meniscus formed on the stem

11.6.2 Clean the hydrometer after each reading in deionized water and store in deionized water between readings. They hydrometer should not be left in the sample after the reading.

11.7 Calculate the final particle sizes and percent smaller than a given diameter using the following equations. These calculations may be done manually or may be done in a spreadsheet.

11.7.1 Percentage of soil in suspension (percent smaller than a given diameter of soil) = $(R \times a)/W$

where R = hydrometer reading with composite correction applied
a = correction factor from Table 1
W = 100 x (air dried mass used for hydrometer x hygroscopic moisture correction factor)/% passing through No. 10 sieve)

Note: Specific gravity of the soil is needed for Table 1. If the specific gravity is not listed on the table, extrapolate to an appropriate correction factor.

11.7.2 Diameter of soil particles = $K (L/T)^{1/2}$

Where K = constant taken from Table 3
L = effective depth taken from Table 2
T = time interval in minutes

Note: Specific gravity of the soil is needed for Table 3. If the specific gravity is not listed on the table, extrapolate to an appropriate K value.

11.7.3 Plot the diameters of the particles on a logarithmic scale as the abscissa and the percentages smaller than the corresponding diameters to an arithmetic scale as the ordinate. Read back the percentage of particles smaller than 0.075 mm, 0.005 mm, and 0.001 mm from the graph and record on the data sheet for entry into the LIMS. Note: depending on the conditions of the experiment, there may not be data for the percentage of particles at 0.001. In that case, report the percentage of particles at the lowest diameter available and footnote the result with the actual diameter.

12.0 QC REQUIREMENTS

12.1 A summary of the main quality control requirements are given below. Other requirements specific to a given client or matrix may also be required. Check with the supervisor or manager to determine if there are additional quality control requirements.

12.2 A hydrometer control should be analyzed periodically or whenever a new hydrometer is used.

12.3 A duplicate should be analyzed with each batch of 20 samples or less. Control limits are compiled by Accutest annually and should be used to determine if matrix problems are present. If the duplicate is outside of the control limits, and all other quality control is within limits, then no reanalysis is necessary, but the QC results must be footnoted to indicate possible sample non-homogeneity or matrix interferences. Until control limits can be generated, default control limits of 20% rpd should be applied.

13.0 DOCUMENTATION REQUIREMENTS

13.1 The analyst should document all relevant information, including all sample weights, all sample and control analysis results, and any relevant comments.

13.2 All reagent identification numbers should be recorded on the sample worksheets. In addition, all reagent information such as lot numbers should also be recorded in the reagent log book.

14.0 DATA REVIEW AND REPORTING

14.1 All samples should be updated to QC batches in the LIMS system. The analyst should calculate all sample results and all duplicate RPD's. They should verify that all calculations are complete and that all reagents are documented and traceable.

14.2 After the analyst review is completed, the supervisor or a designated reviewer shall review the run for technical compliance to the SOP. The supervisor is also responsible for making sure that the QC calculations are done correctly and responsible for reviewing the data entry into the LIMS. No LIMS entry review is necessary when the data is electronically transferred.

14.3 After the supervisor or designated reviewer completes their review, the data is released for client access in the LIMS. The raw data is submitted to the area manager. The department manager does an additional periodic review on the sample data as appropriate. The raw data is then filed electronically in the report generation department.

14.0 POLLUTION PREVENTION & WASTE MANAGEMENT

15.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 15.2.

15.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, EHS004. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:

15.2.1 Non hazardous aqueous wastes.

15.2.2 Hazardous aqueous wastes

15.2.3 Chlorinated organic solvents

15.2.4 Non-chlorinated organic solvents

15.2.5 Hazardous solid wastes

15.2.6 Non-hazardous solid wastes

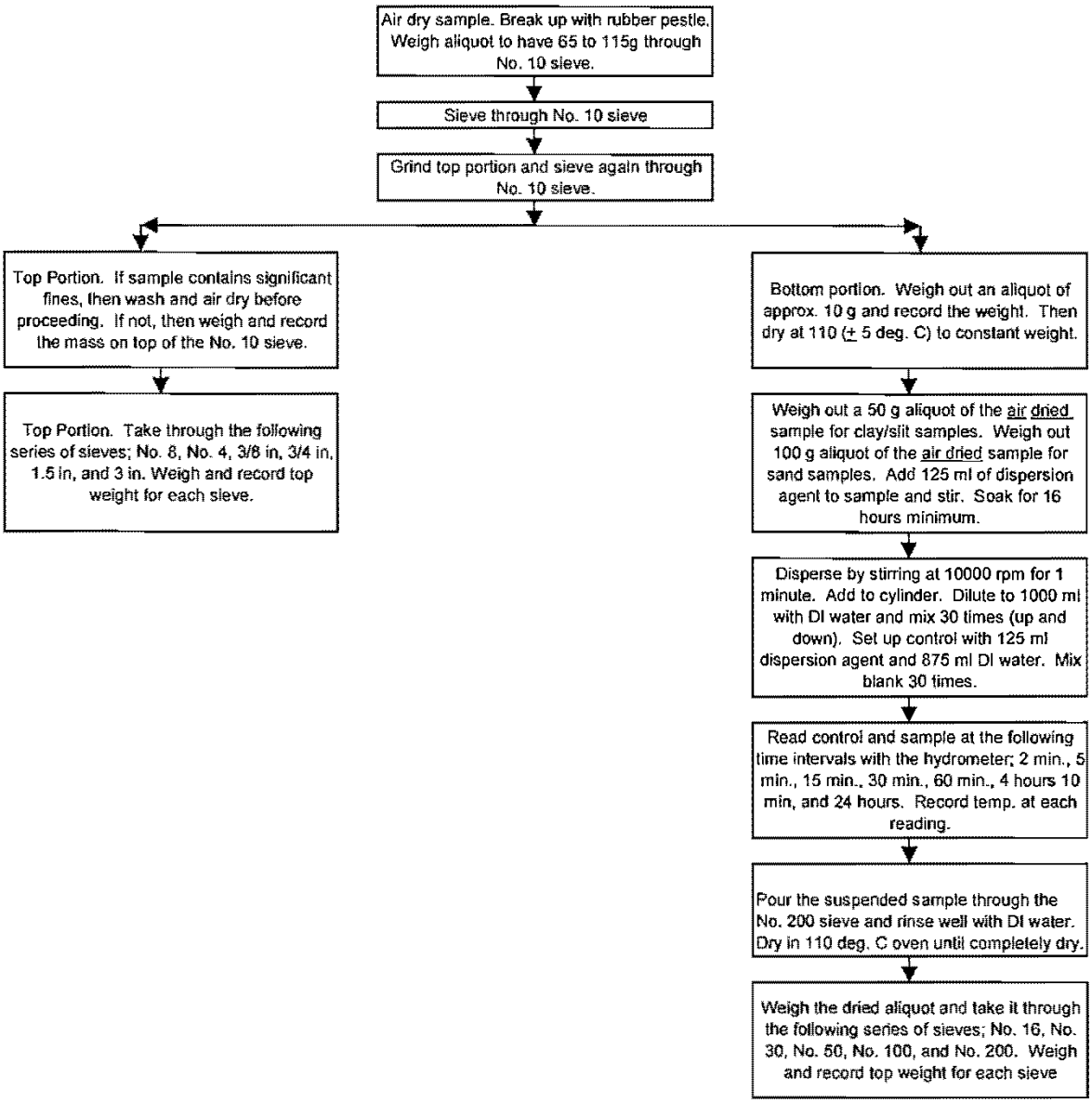
16.0 ADDITIONAL REFERENCES

16.1 Refer also to ASTM D421-85 for additional details on preparation of the soil samples.

16.2 Refer to ASTM D422-63 for Tables 1, 2, and 3

16.3 Refer to SOP EGN247 for the process to use to determine soil specific gravities.

FIGURE 1: SIEVE AND HYDROMETER PROCESS FLOW CHART



Inductively Coupled Plasma - Mass Spectrometry

References: **Method 6020A**, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Draft Update IVA, May 1998.

Method 6020, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update II, September 1994

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Signature: Joseph Watkins Date: 7/11/11

ISSUE AMENDMENTS

Changes since last issue:

Edited signatories.

Inductively Coupled Plasma - Mass Spectrometry

References: **Method 6020A,** Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Draft Update IVA, May 1998.

Method 6020, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Update II, September 1994

1. Scope and Application

Matrices: Inductively coupled plasma-mass spectroscopy (ICP-MS) is applicable to the determination of multi-element trace metals in water and other aqueous samples (surface and saline waters, groundwaters, domestic and industrial wastes), toxicity characteristic leaching procedure (TCLP) extracts, acid-volatile sulfide – simultaneously extractable metals (AVS-SEM)) and solid samples (soils, sediments, sludges, and tissues).

Definitions: Refer to Alpha Analytical Quality Manual.

Inductively coupled plasma-mass spectroscopy (ICP-MS) determines trace metal concentrations in solution. The method is applicable to all of the metals and matrices listed below. This method is approved for use in compliance monitoring programs such as the Clean Water Act (NPDES). All matrices, with the exception of dissolved metals samples, require extraction and/or digestion prior to analysis. The metals listed in the tables of Section 16 can accurately be determined in the range of 0.2 µg/L to 50,000 µg/L for aqueous samples, and in the range of 0.02 to 5000 mg/Kg for solid samples, for samples that do not require dilution.

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of analysts experienced in the operation of the ICPMS and in the interpretation of ICPMS data. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability, analyzing a proficiency test sample and completing the record of training.

After initial demonstration, ongoing demonstration is based on acceptable laboratory performance of at least a quarterly laboratory control sample or acceptable performance from an annual proficiency test sample. A major modification to this procedure requires demonstration of performance. The identification of major method modification requiring performance demonstration is directed by the Quality Assurance Officer and/or Laboratory Director on a case-by-case basis.

Parameter	CAS	Parameter	CAS	Parameter	CAS
Aluminum (Al)	7440-36-0	Copper (Cu)	7440-50-8	Strontium (Sr)	7440-24-6
Antimony (Sb)	7440-36-0	Iron (Fe)	7439-89-6	Silver (Ag)	7440-22-4
Arsenic (As)	7440-38-2	Lead (Pb)	7439-92-1	Sodium (Na)	7440-23-5
Barium (Ba)	7440-39-3	Magnesium (Mg)	7439-95-4	Thallium (Tl)	7440-28-0
Beryllium (Be)	7440-41-7	Manganese (Mn)	7439-96-5	Tin (Sn)	7440-31-5
Boron (B)	7440-42-8	Molybdenum (Mo)	7439-98-7	Titanium (Ti)	7440-32-6
Cadmium (Cd)	7440-43-9	Nickel (Ni)	7440-02-0	Vanadium (V)	7440-62-2
Calcium (Ca)	7440-70-2	Potassium (K)	9/7/7440	Zinc (Zn)	7440-66-6
Chromium (Cr)	7440-43-9	Selenium (Se)	7782-49-2		
Cobalt (Co)	7440-48-4	Silicon (Si)	7440-21-3		

2. Summary of Method

An aliquot of a well mixed, homogeneous aqueous or solid sample is accurately measured or weighed for sample preparation. Prior to analysis, all samples, with the exception of samples requiring dissolved metal analysis, must be "solubilized" or digested in acid using the appropriate sample preparation methods as noted in above. Dissolved metals do not require acid digestion if the samples are filtered and acid preserved prior to analysis. Once the samples have been digested, they are ready for analysis by ICP-MS.

This analytical method entails the simultaneous multi-elemental determination of sub-µg/L concentrations of many trace metals by ICP-MS. The method measures ions produced by a radio-frequency inductively coupled plasma. Samples are nebulized and the resulting aerosol is transported to the plasma torch by argon gas. The ions produced by a radio-frequency inductively coupled plasma are then introduced into a quadrapole mass spectrometer. The ions produced in the plasma are sorted according to their mass-to-charge ratios and quantified with a channel electron multiplier. Interferences must be assessed and valid corrections applied or the data flagged to indicate problems. Interference correction must include compensation for background ions contributed by the plasma gas, reagents, and constituents of the sample matrix.

2.1 Method Modifications from Reference

The calibration blank is used as a reference to monitor changes in internal standard recoveries in QC samples and client samples. This deviates from the reference method which suggests the use of the initial calibration standard. The instrument software can not be changed to perform this analysis. There is no apparent impact to the quality of the data as indicated by successful analysis of PT samples over the period of operation of the instrument.

3. Reporting Limits

Reporting Limits are listed in Table 1.

4. Interferences

4.1 Isobaric elemental interferences occur when an isotope of one element is at the same nominal mass-to-charge ratio (m/z) as an isotope of another element (*i.e.*, Mo 98 and Ru 98). Corrections for isobaric interferences may be made by measuring the intensity due to the interfering element at another isotope and using its natural abundance ratios to correct for its presence at the analytical mass of interest. Most commonly used corrections for isobaric interferences are already present as default interference equations in the ELAN NT software. A list of the corrections used is given in the listing of the isotopes monitored in the 6020A method in Table 3 of this SOP.

Care should be taken that the isotope measured for correction purposes does not suffer from overlap with other isotopes that may be present in the sample. Extreme caution should be exercised when reporting metal concentrations where the "apparent concentration" from an interfering element accounts for 90% of the measured concentration. This can be estimated by closely monitoring the concentrations of the non-spiked metal concentrations in the daily analysis of the ICSA solution.

4.2 Isobaric molecular and doubly-charged ion interferences are caused by ions consisting of more than one atom or charge. Common molecular interferences include ArCl, ClO, nitrogen dimer, oxygen dimer, and oxide species. Most isobaric interferences have been identified in the literature. Isobaric molecular interferences can often be corrected for in the same manner as isobaric elemental interferences, i.e., measuring the intensity present at

another isotope and using isotope ratios to calculate the amount of the interfering species. For example, corrections for interferences of $Ar^{40}Cl^{35}$ on As at mass 75 may be made by measuring the intensity of ArCl present at mass 77 ($Ar^{40}Cl^{37}$) and converting to the apparent intensity of ArCl at mass 75 by using the isotopic ratio of Cl^{37} to Cl^{35}. A list of the corrections used is given in the listing of the isotopes monitored in the ELAN 6020 method in Table 3 of this SOP.

It may be possible to eliminate or minimize isobaric interferences by using the DRCe ICP /MS equipped with a reaction cell. See Section 11.9.

Care should be taken that the isotope measured for correction purposes does not suffer from overlap with other isotopes that may be present in the sample. Extreme caution should be exercised when reporting metal concentrations where the "apparent concentration" from an interfering element accounts for 90% of the measured concentration. This can be estimated by closely monitoring the concentrations of the non-spiked metal concentrations in the daily analysis of the ICSA solution

4.3 Physical interferences are effects associated with the sample nebulization and transport processes. Changes in viscosity and surface tension can cause significant inaccuracies, especially in samples containing high dissolved solids or high acid concentrations. Differences in solution volatility can also cause inaccuracies when organic solvents are involved. If physical interferences are present, they must be reduced by diluting the sample. Another problem that can occur with high dissolved solids is salt buildup at the tip of the nebulizer, which affects aerosol flow rate and causes instrumental drift. The argon flow rate is controlled with a mass flow controller. Changing the nebulizer and removing salt buildup at the tip of the torch sample injector is used as an additional measure to control salt buildup when there is an obvious decrease in instrument sensitivity. An internal standard can also be used to correct for physical interferences, if it is carefully matched to the analyte so that the two elements are similarly affected by matrix changes. When the intensity level of an internal standard is outside of the 70% - 120% range for Method 6020A then the sample must be reanalyzed at a 5 X dilution.

4.4 Memory interference results when analytes in a previous sample contribute to the signals measured in a new sample. Sample deposition and buildup on the sampler and skimmer cones can be minimized by flushing the system with rinse blanks between samples. A normal rinse time of 60 seconds can be increased if memory interference is suspected. Any sample suspected of having memory interference must be reanalyzed.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

5.1 The use of laboratory equipment and chemicals exposes the analyst to several potential hazards. Good laboratory techniques and safety practices shall be followed at all times. Eating, drinking, smoking, or the application of cosmetics is not permitted in the laboratory area. Horseplay of any kind is prohibited. Pipetting by mouth is not permitted. All Personal Protective Equipment (PPE) must be removed before leaving the laboratory area and

before entering the employee lounge or eating area. Always wash your hands before leaving the laboratory. All relevant Material Safety Data Sheets (MSDSs) are kept AlphaNet.

5.2 Approved PPE, which includes Safety Glasses, Gloves and Lab Coats, must be worn at ***all*** times when handling samples, reagents, chemicals, or when in the vicinity of others handling these items, so that dermal contact is avoided. All standards, reagents and solvents shall be handled under a hood using the proper PPE. All flammable solvents must be kept in the flammable storage cabinet, and returned to the cabinet immediately after use. When transporting chemicals, use a secure transporting devise and/or secondary outer container. Chemical storage is properly segregated and adequately ventilated to reduce the possibility of hazardous reactions. Chemical storage in work areas shall be kept to a minimum. Storage on bench tops or other work surfaces, except temporary, is not permitted.

5.3 The toxicity or carcinogenicity of each compound or reagent used in this method has not been precisely defined; however, each chemical compound shall be treated as a potential health hazard. From this viewpoint, exposure to chemicals must be reduced to the lowest possible level by whatever means available. All standards and reagents shall be prepared in a hood while using the proper PPE.

5.4 Spilled samples, solvents, reagents, and water must be cleaned up from bench tops, instruments and autosampler surfaces immediately. A spill is considered a quantity of hazardous material if it is two times greater than the normal working volume. Concentrated solvents, acids or bases present a moderate to extreme hazard to the skin and mucous membranes. If contact with the skin occurs, immediately flush with large volumes of water. In the case of acidic/basic spills, the *Spill Kit* located in each laboratory shall be utilized before attempting to cleanup the spill. Although procedures are designed to minimize the possibility of an accident, all injuries or accidents, regardless of the nature or severity, are to be reported to the Section Head Supervisor immediately. If an employee discovers a potentially unsafe condition, this must be reported to the Section Head Supervisor immediately. No employee should feel compelled to work in a situation where they do not feel entirely informed, trained, or safe.

5.5 Analytical instrumentation poses the unique possibility of exposure to high voltages. Other than the *routine* instrument maintenance, as listed in the front of every Instrument Maintenance Logbook, at no time shall an instrument operator attempt to maintain an instrument alone, or without the proper training, supervision or instruction. Caution must always be used in the presence of moving parts (autosamplers) and hot surfaces (injection ports).

5.6 Compressed gas cylinders shall only be moved with the dolly supplied for this specific purpose. The cap must be on the cylinder while it is being moved. The tank must be secured when in its final position. All spent tanks are to be returned in the same manner, and secured until removed by the vendor. Liquid argon or nitrogen represents a potential cryogenic hazard and safe-handling procedures must be used at all times.

5.7 Care must be taken when handling all liquid samples, digestates, and standards since they are preserved to a pH <2.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

Aqueous Samples for total metal analysis: The volume of sample required is dependent on the analyses requested. Typically, a 500 mL of sample is collected in plastic or glass containers. Samples of this volume should be preserved with 2 mL of 1:1 nitric acid per liter of sample (pH ≤ 2) at time of collection.

Solid samples: A minimum of 10.0 grams of sample must be collected in a glass jar.

6.2 Sample Preservation

Aqueous Samples for total metal analysis: Samples that cannot be acid preserved at the time of collection because of sampling limitations or transport restrictions should be acidified with nitric acid to a pH ≤ 2 upon receipt at the laboratory. Following acidification, the sample must be held for a minimum 16 hours before pouring an aliquot for sample digestion. If conditions do not permit field preservation, this must be noted on the COC and in the laboratory case narrative.

Aqueous samples for dissolved metal analysis: Samples may be field filtered and preserved. If the laboratory is required to filter the samples, the sample must be filtered through a 0.45-µm membrane filter. Glass or plastic filtering apparatus must be acid rinsed to avoid possible contamination. A plastic apparatus must be used when determination of boron or silica is critical. Use a portion of the filtered sample to rinse the filter flask, discard this portion and collect the required volume of filtrate. Immediately following filtration acidify the filtrate with nitric acid to a pH ≤ 2.

6.3 Sample Shipping

None.

6.4 Sample Handling

Aqueous Samples for total metal analysis: The samples can be stored at room temperature or can be refrigerated and maintained at 4°±2°C until digestion and analysis. All aqueous samples must be analyzed within 6 months from date of collection

Solid samples: The samples must be refrigerated and maintained at 4°±2°C until digestion and analysis. All solid samples must be analyzed within 6 months from the date of collection. The hold time for samples that require AVS/SEM analysis is 21 days.

Note: Although mercury is not typically analyzed by ICP-MS, the hold time for samples that require mercury analysis is 28 days.

7. Equipment and Supplies

7.1 Perkin-Elmer ELAN 6100 or ELAN DRCe inductively coupled argon plasma – mass spectrometer (ICP-MS): Capable of providing resolution better than or equal to 1 amu at 10% peak height. The system has a mass range from 6-240 amu with a data system that allows for correction for interferences and the application of the internal standard technique.

7.1.1 ELAN 6100 and DRCe computer system

7.1.2 ELAN software

7.1.3 Printer

7.1.4 Mixing block manifold for on-line addition of internal standards

7.1.5 Autosampler
7.1.6 Peristaltic pump tubing

7.1.6.1 Sample Introduction; Black/Black - 0.76 mm (0.030") i.d

7.1.6.2 Internal Standard Introduction; Green/Orange - 0.38 mm (0.015") i.d.
7.1.6.3 Drain; Black/White – 3.18 mm (0.125") i.d

7.1.6.4 Rinse; Red/Red - 1.14 mm (0.045") i.d

7.1.6.5 Making Connections; Blue/Blue - 1.65 mm i.d

7.1.6.6 Making Connections; Purple/Purple -2.06 mm i.d

7.2 Liquid Argon - 99.999% purity and regulator.

7.3 Oxygen: High purity gas and regulator

7.4 Ammonia: High purity gas and regulator

7.5 Glassware - Assorted Class-A volumetric flasks, beakers, graduated cylinders and pipettes of appropriate sizes for preparing reagents, standards, and measuring sample volumes

7.6 Air Displacement pipetters: Eppendorf brand or equivalent digital pipettes capable of delivering volumes ranging from 0.1 to 5000 µL with an assortment of high quality disposable pipette tips

7.7 Autosampler tubes: 15-mL plastic AS-91 and/or S10

7.8 Digestion tubes: 50-mL plastic with caps

7.9 Analytical balance: Capable of accurate measurement to the nearest 0.01 g

8. Reagents and Standards

Deionized (DI) water is ASTM Type II laboratory reagent grade water or better (*i.e.*, Type I). The Barnstead NANO-pure system provides Type I water used in the preparation of samples and standards. ACS Trace Metal grade chemicals shall be used in all tests. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination. If the purity of a reagent is in question, analyze for contamination. If the concentration is less than the RL then the reagent is acceptable.

Solutions below expire six months from preparation unless noted. All stock and working calibration standards expiration dates are based on manufacturer expiration date or one year from date received. All solutions are stored at room temperature

8.1 Nitric acid (HNO_3), concentrated. Trace metal grade or ultra-pure from sub-boiling distillation is preferred. Suggested suppliers include: Seastar ™- Sub-boiling distilled grade, Sidney, BC; J. T. Baker - ULTREX® Grade; and Fisher - Optima Grade. Lots should be checked for purity prior to use and the results stored in a reagent check log book.

8.2 Hydrochloric acid (HCL), concentrated. Trace metal grade or ultra-pure from sub-boiling distillation is preferred. Suggested suppliers include: Seastar™ - Sub-boiling distilled grade, Sidney, BC; J. T. Baker - ULTREX® Grade; and Fisher - Optima Grade. Lots should be checked for purity prior to use and the results stored in a reagent check log book.

8.3 2% (vol/vol) Nitric acid. Prepare by adding 40 mL of concentrated nitric acid to 2000 mL reagent water in a clean glass bottle or 180 mL of concentrated nitric acid to 9000 mL reagent water in a clean carboy. This acid minimizes the damage to the interface and also minimizes isobaric molecular-ion interferences.

8.4 10% (vol/vol) Nitric acid. Prepare by adding 200 mL of concentrated nitric acid to 2000 mL reagent water in a clean glass bottle or 900 mL of concentrated nitric acid to 9000 mL reagent water in a clean carboy. This acid is the maximum concentration used for calibration standards, samples and rinse acid as recommended by the instrument manufacturer.

8.5 0.1% (vol/vol) Sub-boiling distilled Nitric acid. Prepare by adding 1.0 mL of concentrated sub-boiling distilled nitric acid to 1000 mL reagent water in a clean polyethylene bottle.

8.6 5% (vol/vol) Nitric acid. Prepare by adding 50 ml of concentrated nitric acid to 950 mL reagent water in a clean polyethylene bottle.

8.7 Single element stock solutions for the following elements are typically maintained in the laboratory. These are normally purchased as 1000 mg/L standards from Fisher Scientific or equivalent. The ICP MS is capable of determining concentrations of 73 elements in the Periodic Table. Other calibration standards, not present in Table 4, may be purchased as necessary for non-routine analyses.

- **8.7.1** Arsenic
- **8.7.2** Beryllium
- **8.7.3** Selenium
- **8.7.4** Strontium
- **8.7.5** Tin
- **8.7.6** Zinc

8.8 Tuning Solution Stock standards consist of 1000 mg/L beryllium (Be), cobalt (Co), indium (In), thallium (Tl), and uranium (U).

8.8.1 100 mg/L Tuning Solution Intermediate Standard . Prepare 1:10 dilutions by pipetting 100 µL of each 1000 mg/L single element stock solutions of Co, In, Tl, and U into a 1 mL autosampler cup containing 900 µL 2% nitric acid.

8.8.2 Tuning solution: 150 µg/L Be and 10 µg/L Co, In, Tl, and U. Prepare by pipetting 100 µL of 100 mg/L tuning solution standard in 10.8.1 and 150 µL of 1000 mg/L Be into a 1 liter volumetric flask filled with 200 mL of reagent water and 20 mL of concentrated nitric acid. Dilute to a final volume of 1 liter with reagent water and mix well.

Can also order Perkin Elmer part # N812-2014 for the tuning solution.

8.9 The Internal Standard Solution is prepared from single element standards consisting of 100 mg/L Germanium (Ge), 100 mg/L indium (In), 100 mg/L lithium (Li^6), 100 mg/L scandium (Sc) and 100, mg/L terbium (Tb).

8.9.1 Add 10 mL of concentrated nitric acid to a 500 ml volumetric flask containing 250 ml of DI water.

8.9.2 Add 5 ml of 100 mg/L Li^6. Li^6 is used routinely when analyzing beryllium and boron or other elements as needed. If these elements are not being analyzed then it is not necessary to add this internal standard.

8.9.3 Add 1.0 mL of a stock solution containing 100 mg/L of Sc.

8.9.4 Add 0.5 mL of 100 mg/L of In, Ge and Tb stock solutions

Note: All solutions including calibration blanks, calibration standards, samples, quality control standards, and quality control samples must be spiked with the same level of the internal standard spiking solution. Use the above solution in conjunction with the on-line mixing block for addition of internal standards to calibration standards and samples. Internal standard intensities should be between 100,000 cps and 1500,000 cps. The internal standard solution as made here should be diluted 1:2 for the DRCe ICP MS instrument due to the greater sensitivity of the instrument.

Note: Other internal standards are suggested for use such as Y, Ho, Lu and Bi and may be used if poor performance is observed from the above standards

8.10 Calibration Stock Standard and Intermediate Working Standard Solutions

Intermediate Working Standard solutions are prepared from certified vendor Stock Standard solutions and include those analytes listed below. Vendor sources are subject to change and equivalent solutions may be used.

Mixed calibration standard solutions must contain the appropriate types and volumes of acids so that the standards are matrix matched with the sample digestates. The acid matrix for all standards is 0.1% HNO_3 (10.5), 2% HNO_3 (10.3), 5% HNO_3 (10.6) and 10% HNO_3 (10.4). These concentrations do not damage to the ICP-MS interface and also minimizes isobaric molecular-ion interferences with the analytes. A diluent of the acid matrix preparation is described in 10.3 and 10.4. *Note: Silver and antimony may precipitate out of solution at higher concentrations between 50-500 µg/L. Higher silver concentrations (>500 µg/L) require additional HCl. Caution: Many metal salts are extremely toxic if inhaled or swallowed. The Health and Safety precautions noted in Section 5 must be followed.* All standards are stored in the metals instrument laboratory at room temperature. The expiration dates are monitored from vendor supplied dates. The element or mix of elements that expires first in a solution dictates the expiration date for the entire solution. Standard and spike solutions are labeled using an alpha-numeric system based on the date prepared. All standards or spikes that are prepared are recorded in the metals laboratory logbooks. It is suggested that standards with a final concentration of less than 1 mg/L be prepared daily

8.10.1 **CPI-19:** *Sb, As, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, Se, Tl, Ti, V and Zn* from CPI containing all of the listed elements at 100 mg/L.

8.10.1.1 **(Date)-C1:** Intermediate working standard is prepared by adding 1 mL of CPI-19 (10.9.1) to 9 ml of 0.1% Acid (10.5). This standard is prepared approximately every two weeks and is used to prepare the daily calibration standards

8.10.2 **CPI-7:** *K* at 1000 mg/L, Si at 50 µg/ml, and *Al, Ba, B, Ag and Na* at 100 mg/L from CPI at the concentrations noted.

8.10.2.1 **(Date)-C2:** Intermediate working standard is prepared by adding 1 mL of CPI-7 (10.9.2) to 9 ml of 0.1% Acid (8.5). This standard is prepared

approximately every two weeks and is used to prepare daily calibration standards.

8.10.3 AT-3: *Al, Ca, Fe, Mg, K, and Na* a custom mix from Inorganic Ventures at 500 mg/L for each element.

8.10.3.1 Date)-C3: Intermediate working standard is prepared by adding 1 mL of AT-3 (8.9.3) to 9 ml of 0.1% Acid (8.5). This standard is prepared approximately every two weeks and is used to prepare daily calibration standards.

8.10.3.2 (Date)-C4: This standard is prepared by pouring AT-3 (8.9.3) into a satellite container for use in preparing daily calibrations standards.

8.10.4 IQC-026: *Sb, Ag, Al, As, B, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Na, Ni, Se, Tl, Ti, V and Zn* at 100 mg/L, *Si* at 50 mg/L and *K* at 1000 mg/L from Ultra Scientific.

8.10.4.1 (Date)-I1: Intermediate working standard is prepared by adding 1 mL of IQC-026 (8.9.4) to 9 ml of 0.1% Acid (8.5). This standard is prepared approximately every two weeks and is used to prepare daily calibration standards.

8.10.5 XAQU-15: *Fe, Al, Mg, Na, Ca and K* a custom mix from SPEX at 500 mg/L for each element listed.

8.10.5.1 (Date)-I2: Intermediate working standard is prepared by pouring XAQU-15 (8.9.5) into a satellite container for use in preparing daily calibrations standards.

8.11 Daily Calibration Standards

An Initial Calibration Curve is prepared for each level and is described below. Every element is *not* in each level of the calibration curve. At minimum, a high level, a low level that confirms the reporting limit (STD1), and a calibration blank (STD0), is used. See Table 4 for a list of the initial calibration concentrations. Standards are prepared in either 0.1% (8.5), 2% (8.3), 5% (8.6) or 10% (8.4) nitric acid to matrix match standards to samples depending on the how samples and sample digests are diluted for analysis. Standards used to analyze undiluted Dissolved Aqueous samples are prepared in 0.1% nitric acid. Standards used to analyze undiluted Total Aqueous samples prepared by hot plate (MP-004) are prepared in 5% nitric acid. Soil/Sediment samples prepared by Hot Plate Method 3050 (MP-001) and Tissue samples prepared by microwave oven (MP-003) and diluted 1:2 are prepared in 10% nitric acid. Standards used to analyze Total Aqueous samples (11.4) prepared by hot plate (MP-004), diluted 1:5, and Soil/Sediment samples prepared by Hot Plate Method 3050 (MP-001), diluted 1:5, are prepared in 2% nitric acid.

8.11.1 STD0 (Calibration Blank): Calibration Blank: A solution containing the same acid matrix as samples and standards

8.11.2 STD1 (Reporting Limit Standard): Prepared from the ICV Standard (8.12). Add 100 µL of ICV standard to 50 ml digestion tube and bring to volume with diluent acid. The final concentration of each element is: *Sb, Ag,, As, B, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Mo Ni, Se, Tl, Ti, V and Zn* at 0.1 µg/L, *Al, Ca, Fe, Mg,* at 10.1 µg/L, *Si* at 0.05 µg/L and *K* at 11 µg/L.

8.11.3 STD2: Add 50 µL of (Date)-C1 (10.9.1.1) and 100 µL of (Date)-C3 (8.9.3.1) to a 50mL digestion tube and bring to 50mL with the diluent acid. The final concentration of each element is: *As, Be, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sb, Se , Ti, Tl, V and Zn* at 10 µg/L; *Al, Ca, Fe, and Mg* at 110 µg/L; *K and Na* at 100 µg/L; and *Si* at 5 µg/L. Note: only 16 of the 19 elements in this mix are evaluated at this concentration level.

8.11.4 **STD3:** Add 100 µL of (Date)-C1 (10.9.1.1) and 100 µL of (Date)-C4 (8.9.3.2) to a 50mL digestion tube and bring to 50mL with the diluent acid. The final concentration of each element is: *As, Be, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sb, Se, Ti, Tl, V and Zn* at 20 µg/L; *Al, Ca, Fe, and Mg* at 1020 µg/L; *K and Na* at 1000 µg/L; *Hg* at 5 µg/L, and *Si* at 10 µg/L. Note: only 16 of the 19 elements in this mix are evaluated at this concentration level.

8.11.5 **STD4:** Add 500 µL of (Date)-C1 (8.9.1.1) and 1000 µL of (Date)-C4 (8.9.3.2) to a 50mL digestion tube and bring to 50mL with the diluent acid. The final concentration of each element is: *As, Be, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sb, Se, Ti, Tl, V and Zn* at 100 µg/L; *Al, Ca, Fe, and Mg* at 10100 µg/L; *K and Na* at 10000 µg/L; and *Si* at 50 µg/L. Note: only 16 of the 19 elements in this mix are evaluated at this concentration level.

8.11.6 **STD5:** Add 500 µL of (Date)-C2 (8.9.2.1) to a 50mL digestion tube and bring to 50mL with the diluent acid. The final concentration of each element is: *Ag, B and Ba* at 100 µg/L; *Si* at 50 µg/L. Note: These three metals are only performed with a 3 point calibration rather (including the blank).

8.12 Initial calibration verification (ICV) and continuing calibration verification (CCV)

The ICV and CCV standards are prepared from sources separate from the initial calibration curve and are used to verify the initial calibration curve throughout the analytical sequence. See Table 4 for a list of the ICV/CCV concentrations. To prepare this solution add 0.25mL of (Date)-I1 (8.9.4.1) and 0.5mL of (Date)-I2 (8.9.5.1) to a 50mL digestion tube and bring to 50mL with the diluent acid. The final concentration of each element is: *As, Ag, Sb, B, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Mo, Ni, Se, Si, Ti, Tl, V and Zn* at 50 µg/L; *Al, Ca, Fe, and Mg* at 5050 µg/L; *K* at 5500 µg/L; and *Si* at 25 µg/L.

8.13 Calibration blank (STD0),

initial and continuing calibration blanks (ICB and CCB) are the analysis of the matrix diluent and are analyzed prior to the initial calibration curve and after the ICV and CCVs, respectively.

8.14 Contract Required Detection Limit – CRDL

The detection limit of an analysis is determined through method detection limit studies and supported by a calibration standard which is at or below the reporting limit (STD1 – 8.10.2). A contract required detection limit (CRDL) can also be verified by determining the analyte recovery from a CRI check standard. The analyte concentrations of this standard and acceptance ranges for recoveries may be established by project specifications. This check standard can be analyzed separately following the initial calibration and/or at the end of the analytical sequence.

8.15 Interference Check Solutions – ICS

Two Interference Check Solutions (ICSA and ICSAB) are prepared to contain known concentrations of interfering elements and analytes that will provide an adequate test of correction factors. Concentrations of the interfering analytes correspond to concentrations in Table 1 of USEPA, "Method 6020A - Inductively Coupled Plasma-Mass Spectrometry," in Test Methods for Evaluating Solid Waste, SW-846, 3rd Edition, Revision 1, September 1998.

The sensitivity if the ICP MS to most analytes allows sample digests from the preparations in 2.2 – 2.5 to be diluted prior to analysis and still meet required reporting. Dilution can reduce isobaric and physical interferences as well as instrument exposure to strong acids used in sample preparation. If sample digests are diluted prior to analysis, then the concentrations of the interferent analytes in the ICS solution are reduced proportionately during preparation of the ICSA and ICSAB standards.

Digests of water samples may be analyzed without dilution, at 1:5 dilution or higher to bring analyte concentrations within the linear dynamic range of the instrument. Digests of soil/sediment samples and tissue samples must be diluted 1:2 in DI water, at a minimum, to

reduce the high acid concentration used in the preparation. The instrument manufacturer suggests a maximum acid concentration of 10% be used during analysis

Three solutions are used to prepare the interference check solutions ICSA and ICSAB.

8.15.1 6020ICS-9A: Supplied by Inorganic Ventures with concentrations of 20,000 ppm Cl; 3000 ppm Ca; 2500 ppm Fe and Na;1000 ppm Al, Mg, P, K, and S; 2000 ppm C; 20 ppm Mo and Ti

8.15.2 (Date)-C1: See 8.10.9.1.1

8.15.3 (Date)-C2: See 8.10.2.1

8.15.4 Interferent concentrations based on sample dilution are given in the following table.

Interferent	No Dilution (mg/L)	1:2 Dilution (mg/L)	1:5 Dilutioin (mg/L)
Cl	2000	1000	400
Ca	300	150	60
Fe, Na	250	125	50
Al, Mg, P, K, S	100	50	20
C	200	100	40
Mo, Ti	2	1	0.4

8.15.5 The ICSA Solution is prepared in a 50 ml screw cap digestion tube by adding 5 ml (no dilution), 2.5 ml (1:2 dilution) or 1 ml (1:5 dilution) of 6020ICS-9A (10.14.1) to 0.1% nitric acid (8.5), 2% nitric acid (8.3), 5% nitric (8.6) or 10% nitric acid (8.4) depending on the acid being used for analysis (see section 8.10). This solution can be used for multiple analyses and can be stored until the expiration date of the standard.

8.15.6 The ICSAB Solution is prepared as a 10 ml aliquot according to the following table and must be prepared daily as some analytes are not stable in solution. The final concentrations of analytes in (Date)-C1 are 100 µg/L and 50µg/L for (Date)-C2 with the exception of *Mo* and *Ti* which are present as interferents.

Note: Method 6020A suggests a concentration of 200 µg/L for Cr, Co, Cu, Mn, Ni and V. The reduced concentrations prepared for this standard represent a more rigorous test of isobaric corrections.

Solution	No Dilution (mL)	1:2 Dilution (mL)	1:5 Dilution (mL)
6020ICS-9A (8.4.1)	1	0.5	0.2
(Date)-C1	0.1	0.1	.1
(Date)-C2	.05	.05	.05
Acid (8.3, 8.4, 8.5, 8.6)	8.85	9.35	9.65

8.16 Laboratory Control Sample (LCS) or Laboratory Fortified Blank (LFB)

for aqueous samples is prepared from a source other than the calibration standard sources.

It is prepared and stored for use in the metals preparation laboratory. The LCS for solid samples is either a liquid LCS/LFB or a solid LCS purchased from ERA at known and certified values. See the metals preparation SOPs for LCS preparation details.

8.17 Matrix Spike (MS) solution for aqueous and solid samples is the same solution as the aqueous LCS/LFB in 10.15. It is prepared and stored for use in the metals preparation laboratory. See the metals preparation SOPs for MS preparation details.

8.18 Daily Performance Standard: Prepare by adding 0.1 ml of a 1:10 dilution of 1000 mg/L stock Ba, Ce, Mg, Pb, In, U and Rh standards to 1 L volumetric flask containing 100 ml of Di water with 20 ml of concentrated HNO_3. Mix and bring to volume with DI water.

8.19 Dual Detector Calibration Solution: Add 0.15 ml of CPI-19 stock (or equivalent), 0.15 ml of CPI-7 stock (or equivalent), 0.15 ml of 500 ml/L Al, Ca, Fe, K, Mg and Na stock and 0.1 ml each of 1000 mg/L As, Be, and Zn and 0.2 ml of 1000 mg/L Se stock to 100 ml volumetric flask containing 2% HNO_3. Bring to volume with 2% HNO_3. This solution is required for optimization of the pulse and analog state detectors. Other analytes may be added to this solution as needed.

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank

9.1.1 A method blank must be analyzed once per every 20 samples or per metals digestion batch, whichever is more frequent.

9.1.2 Metal concentrations must not be detectable in the method blank at values greater than the reporting limit.

9.1.3 Corrective Action: Analysis according to the appropriate analytical SOP may be repeated once to see if an analytical error has occurred. Digestion of the method blank and all associated samples must be performed until the method blank for the out of control metal is in control. Samples cannot be analyzed until an acceptable method blank analysis is obtained. Exceptions may be made with approval of the Section Head if the samples associated with an out of control method blank are below the reporting limit for the affected metal or if the concentrations of the affected metal are greater than 10x the blank level in the samples. In such cases, the sample results are accepted without corrective action for the high method blank result. The client must be notified in the project narrative associated with the sample results.

9.2 Laboratory Control Sample (LCS) / Laboratory Fortified Blank (LFB)

9.2.1 The LCS/LFB is from a second source to verify the accuracy of the digestion and analytical procedures. The LCS/LFB is digested along with the samples. An LCS/LFB must be digested and analyzed once per every 20 samples or per metals digestion batch, whichever is more frequent.

9.2.2 The acceptable recovery QC limits are 80%-120% (Method 6020A) for an aqueous LCS/LFB and 75%-125% (or within manufacturer's control limits) for the solid LCS.

9.2.3 Corrective Action: May repeat analysis once to see if an analytical error has occurred. If the LCS/LFB recovery is still out of control, re-digest and re-analyze

the LCS/LFB and all associated samples. Samples cannot be analyzed until an acceptable LCS/LFB is obtained. Exceptions may be made with approval of the Section Head if the samples associated with the out of control LCS/LFB are also associated with a matrix spike that is in control. This is an acceptable measure of accuracy of the digestion and analytical procedures. An explanation of this out of control LCS recovery must be included in the project narrative to the client and the sample data reported with the acceptable MS results as batch QC.

9.3 Initial Calibration Verification (ICV)

9.3.1 Initial Calibration

9.3.1.1 A three-point calibration curve must be performed if the CRI standard is not analyzed.

9.3.1.2 The correlation coefficient must be r ≥0.995.

9.3.1.3 Corrective Action: Re-calibrate until criteria are met.

9.3.2 Initial Calibration Verification (ICV) Check Standard

9.3.2.1 The initial calibration verification check standard is from a second source to verify the accuracy of the standard curve. The concentration of the ICV is at approximately the mid-level of the calibration curve.

9.3.2.2 The acceptable recovery QC limits for the ICV is 90-110%. In addition, the relative standard deviation between three replicate readings must be less than 5% RSD.

9.3.2.3 Corrective Action: May repeat analysis once to see if an analytical error occurred. If the ICV still exceeds the control limits, re-calibrate the instrument.

9.3.3 Initial Calibration Blank (ICB)

9.3.3.1 An ICB must be analyzed immediately following the ICV.

9.3.3.2 The acceptance limit for the ICB is ± 3 times the Instrument Detection Limit (IDL).

9.3.3.3 Corrective Action: May repeat analysis once to determine if analytical error has occurred. Results may be reported from the analysis if the ICB concentration is less than the reporting limit. If the ICB still exceeds the reporting limits, re-calibrate the instrument and re-analyze a fresh blank.

9.4 Continuing Calibration Verification (CCV)

9.4.1 Continuing Calibration Verification (CCV) Check Standard

9.4.1.1 A CCV must be analyzed at a minimum of every 10 samples and at the close of an analytical sequence. The concentration of the CCV is at approximately the mid-level of the calibration curve. This standard monitors instrument performance throughout the duration of the analytical sequence.

9.4.1.2 The acceptable recovery QC limits for the CCV is 90-110%. In addition, the relative standard deviation between three replicate readings must be less than 5% RSD.

9.4.1.3 Corrective Action: May repeat analysis once to see if an analytical error occurred. If the CCV still exceeds the control limits, re-calibrate and re-analyze all samples since the last acceptable CCV.

9.4.2 Continuing Calibration Blank (CCB)

9.4.2.1 A CCB must be analyzed immediately after every CCV

9.4.2.2 The acceptance limit for the CCB is ± 3 times the IDL.

9.4.2.3 Corrective Action: Results may be reported from the analysis if the CCB concentration is less than the reporting limit. If not, repeat analysis once to see if an analytical error occurred. If the CCB still exceeds the reporting limit, re-calibrate the instrument and re-analyze a fresh blank. All samples associated with the out of control metals in the CCB must be re-analyzed (since the last acceptable CCB). Exceptions may be made with approval of the Section Head if the samples associated with the out of control method blank are non-detect for the affected metals or if sample concentrations for the affected metals are greater than 10x the blank levels. In such cases, the sample results are accepted without corrective action for the high CCB and the client is notified in a project narrative associated with the sample results.

9.5 Matrix Spike

9.5.1 A matrix spike must be performed once per 20 samples (5% frequency) and is from a second source to verify the accuracy of the digestion and analytical procedures. The matrix spike recovery is calculated as follows:

$$\% \text{ Recovery} = \frac{MS_{recovery} - R1}{MS_{true\ value}} \times 100$$

When project specifications dictate, a Matrix Spike Duplicate (MSD) may also need to be performed at the same frequency as the MS.

9.5.2 The acceptable recovery QC limits for a MS/MSD is 75%-125% for both the solid and aqueous MS/MSD pair. Calculate the %RPD as in 12.3.2 above when analyzing a MS/MSD pair. The acceptable %RPD is ≤ 20%.

9.5.3 Corrective Action: May repeat analysis once to see if an analytical error has occurred. If the % recovery or %RPD still exceeds the control limits and the LCS is compliant; include a project narrative with the results to client noting that there may be potential matrix effects on the accuracy or precision of the affected metals results as evidenced by matrix spike recovery or %RPD outside of QC limits.

9.6 Laboratory Duplicate

9.6.1 Duplicate analyses (matrix duplicate) must be performed once per 20 samples (5% frequency).

9.6.2 Acceptable relative percent difference (RPD) for duplicate analysis is ≤ 20 % for both aqueous and solid matrices. Acceptance criterion is not applicable to sample concentrations less than 5 times the reporting limit. Calculate RPD as follows:

$$RPD = \frac{R1 - R2}{\frac{[R1 + R2]}{2}} \times 100$$

9.6.3 Corrective Action: May repeat analysis once to see if an analytical error has occurred. If the % RPD still exceeds the control limits; include a project narrative with the results to client noting that there may be potential matrix effects on the precision of the affected metals results as evidenced by the matrix duplicate RPD exceedence

9.7 Method-specific Quality Control Samples

9.7.1 Tuning Solution, Mass Calibration, and Resolution Checks

9.7.1.1 The tuning solution, mass calibration, and resolution checks are required prior to sample analysis. The tuning solution must be analyzed 4 times prior to instrument set up at the beginning of the day.

9.7.1.2 The analytes in the tuning solution must meet ≤5 percent relative standard deviation. The mass calibration must not differ by more than 0.1 amu from the true value. The resolution must be less than 0.9 amu full width at 10 percent peak height.

9.7.1.3 Corrective Action: Adjust the mass calibration to the correct value or correct the problem until criteria are met.

9.7.2 CRI Standard Check Sample (Reporting Limit Standard)

This solution is used to verify instrument sensitivity at the reporting limit. This standard is routinely analyzed as the lowest standard in the initial calibration curve, or STD1, see Section 8.13. When included in the initial calibration curve, the curve must meet the criteria for linearity (r = 0.995). When project specifications dictate, the CRI can be analyzed separately from the initial calibration. The concentration of the CRI, when analyzed as a separate check from the initial calibration curve, is equivalent to the reporting limit for each element in STD1, see Table 1, or at higher levels representing project specific reporting limits. See Section 8.8.2 for preparation details. This check standard, when analyzed, follows the ICV and ICB.

9.7.2.1 The CRI Check sample, when analyzed per client specifications, must be analyzed at the beginning of an analytical run or twice during every 8-hour work shift, whichever is more frequent. These solutions verify the accuracy at the low end of the calibration curve.

9.7.2.2 Results for all metals in the CRI solution must be within the 50-150% recovery criteria. When performing work for the Department of Defense (DoD, Army Corps of Engineers or the US Navy) the CRI acceptable recovery criteria is 80-120%.

9.7.2.3 Corrective Action: May repeat analysis once to see if an analytical error occurred. If the CRI solutions still exceed the control limits, re-calibrate and/or re-analyze a fresh CRI solution. All samples associated with the out of control metals in the CRI must be re-analyzed (since the last acceptable CRI check sample).

9.7.3 Interference Check Samples (ICSA and ICSAB) Solutions

9.7.3.1 The ICSA and ICSAB solutions must be analyzed at the beginning of an analytical run or every 12-hour work shift, whichever is more frequent. These solutions verify the isobaric corrections.

9.7.3.2 Results for all spiked non-interference metals in the ICSAB solution must be within 80-120% recovery criteria. It may be necessary to correct concentrations measured in the ICSAB solution with background concentrations measured in the ICSA solution. Results for aluminum, calcium, iron, sodium, potassium, and magnesium in the ICSA solution should be within 80-120% recovery, however, depending on the sample dilution used, concentrations of the these elements may be close to or exceed the linear range of the instrument which can cause the channel to saturate.

9.7.3.3 Corrective Action: May repeat analysis once to see if an analytical error occurred. If the ICSA or ICSAB solutions still exceed the control limits, re-calibrate and/or re-analyze a fresh ICSA or ICSAB. If the sample results are accepted without corrective action for the ICSA or ICSAB exceedence(s), the client must be notified in a project narrative associated with the sample results.

Note: If an interference is suspected, use of computerized compensation or comparison with an alternate method such as graphite furnace is recommended.

9.7.4 Internal Standard Recovery

9.7.4.1 Internal standard intensities must be monitored in all solutions.

9.7.4.2 Intensities of internal standards in all subsequent analyses of instrument QC samples (including ICV, ICB, CCV and CCB) solutions must be within 70% -120% of the levels in the original calibration blank. Intensities of internal standards in samples must be within the same limits as the QC samples.

9.7.4.3 Corrective Action: If the instrument QC sample does not meet criteria, may reanalyze once to determine if analytical error has occurred. If QC sample still does not meet criteria, terminate the analysis for analytes associated with the internal standard, correct the problem, re-calibrate, and reanalyze all affected samples since the last in-control CCV/CCB. If a sample does not meet criteria, may reanalyze the sample and/or dilute the sample five-fold and reanalyze. This procedure is followed for the sample until the internal standard intensities fall within the prescribed window.

9.7.5 Serial Dilution Analysis

9.7.5.1 Serial dilution analysis must be performed once per 20 samples (5% frequency).

9.7.5.2 Analysis of a 1:5 dilution must agree within 10% of the original determination, if the metal concentration is sufficiently high (minimally, a factor of 50 above the method detection limit) in the original undiluted analysis.

9.7.5.3 Corrective Action: Analysis may be repeated once to see if an analytical error has occurred. If the %D still exceeds the control limits; include a project narrative with the results to client noting that there may be potential matrix effects on the accuracy of the affected metals results as evidenced by the serial dilution %D exceedence.

9.7.6 Post Digestion Spike (PDS)

9.7.6.1 Post digestion spike analysis may be performed if the MS or MSD does not meet recovery criteria. A known spike amount is added to a portion of a prepared sample, or its dilution. The spike addition should produce a minimum level of 10 times, and a maximum of 100 times, the method detection limit. If the spike is not recovered within the specified limits, a matrix effect should be suspected.

9.7.6.2 The post digestion spike recovery is 75%-125% of the known value.

9.7.6.3 Corrective Action: If the post digestion spike exceeds the control limits; include a project narrative with the results to client noting that there may

be potential matrix effects on the accuracy of the affected metals results as evidenced by the post digestion spike exceedence.

9.8 Method Sequence

Initial calibration curve (Total of 6 standards, 2-3 levels for each element)
ICV
ICB
CRI – If required
ISCA
ICSAB
Method Blank
LCS
Sample analysis (samples 1-6)
CCV
CCB
Sample analysis (7-16)
CCV
CCB
Sample analysis (17-26)
CCV
CCB

10. Procedure

10.1 Equipment Set-up

10.1.1 Prior to using the Perkin-Elmer ELAN 6100 and DRCe ICP/MS, the operator must read and become familiar with the operating procedure guidelines specified in the operating manual. The analyst must be trained and familiarized with the instrument software provided by the manufacturer. The instrument must be set up with the proper operating parameters and conditions described in the Perkin-Elmer ELAN 6100 and DRCe ICP/MS operating manual. The criteria for the background correction points, analytical dynamic ranges, method and instrument detection limits and isobaric molecular-ion correction equations must be established and documented prior to initial calibration.

10.1.2 The plasma torch must be aligned before ignition and is done with an alignment tool supplied with the instrument. The procedure centers the torch within the load coil and adjusts the distance of the torch to the sampler cone surface. This is outlined in the Elan 6100 Hardware Guide. This is not required on a routine basis, only initially upon instrument set up and following any changes, such as removal and cleaning of the plasma torch. The instrument must become thermally stable (usually 30-60 minutes) before beginning operation.

10.1.3 Isobaric corrections must be put into the equations page of any method used to generate quantitative analytical data. The correction equations can be found in Table 3. These corrections are based on natural isotopic abundance's and cannot be altered.

10.1.4 A linear dynamic range (LDR) study must be conducted annually. The LDR is determined by analyzing increasingly higher standard concentrations of each element until the observed concentrations are no more than ± 10% of the true value of the standard. Sample analyte concentrations that are above the linear dynamic range must be diluted and re-analyzed. The linear dynamic range must be established for each analytical run by analysis of a high level standard or Linear Range Verification (LRV) standard. Results greater than the daily calibration range but within the linear calibration can be reported provided that analyte recovery from the LRV is within 10% of the true value. If the

recovery from the LRV is outside of the 10% acceptance limit then samples may be diluted below the concentration of the highest calibration standard or reanalyzed. The linear dynamic range must be checked and verified annually. See Table 5 for the current linear range.

10.2 Initial Calibration

10.2.1 Prior to daily calibration, inspect the sample introduction system including the nebulizer, torch, injector tube and uptake tubing for salt deposits, dirt or debris that could constrict flow and affect instrument performance. Clean the system when needed following the manufacturer's instructions.

10.2.2 A series of calibration standards are prepared for the initial calibration curve as described in Section 8.0. The preparation date of these standards, the initials of the analyst, the lot number of the source material, stock concentrations, volumes used, final volumes, final concentrations and manufacturer must be recorded in the metals standard preparation logbook. All standards are traceable to NIST via internal and external calibration checks. *Certificates of Analysis* accompany the receipt of standard solutions and are kept on file in the laboratory. The Perkin-Elmer ELAN 6100 and DRCe are calibrated using a multi-point calibration curve consisting of a blank and a two to three standards per analyte. The standards are named, for example, "C" for calibration, plus "Date" for the date prepared, followed by the letter M and a number 1, 2, 3 etc. for first, second or third set of standards prepared that day. "I" is used to determine the ICV standard. Standard "I040402M1" is the first ICV standard for the ICP MS made on 04/04/02. Standard "I040202M2" is the second ICV standard for the ICP MS made on 04/02/02. This nomenclature is for traceability and to distinguish calibration standards from independent check standards and field samples.

10.2.3 A Linear Through Zero curve type is be selected for all analytes.

10.3 Equipment Operation and Sample Processing

Samples are prioritized by the Section Head for analysis based on hold time and client due date. Section 11 outlines the steps for data reporting that will contain the sample analysis final results.

10.3.1 Preliminary treatment or sample preparation of most matrices is necessary because of the complexity and variability of sample matrices. Aqueous dissolved samples that have been pre-filtered and acidified do not require acid digestion as long as **the samples and standards are matrix matched.** See the sample preparation SOPs.

10.3.2 Ensure that the instrument configuration and operating procedures established in Section 10.1 are selected.

10.3.3 Affix clips to the peristalic pump windings and open the Device window, click on Connect and click on the right pointing arrow (counterclockwise). Check that the fluid is flowing through all tubing and that waste is flowing out of the spray chamber. Initiate the plasma and allow a warm-up of 30-60 minutes.

10.3.4 Conduct mass calibration and resolution check.

Note: Tuning and optimization procedures are performed without the Internal Standard mixing block in-line for The ELAN 6100.

10.3.4.1 Open the Tuning workspace. Aspirate the Tuning Solution (10.7) solution containing Be, Co, In, Tl and U. Click on Tune Mass Spec. The measured mass difference must be less than 0.1 amu from the actual value. The resolution must be less than 0.9 amu full width at a 10% peak height (the instrument default setting is 0.65 amu). If the resolution is not achieved for an element, the

Resolution Digital to Analog Conversion (Res. DAC) value is changed for that element (increasing the DAC value by 30 units will decrease the peak width by 0.1 amu). If the Measured Mass values are not within 0.1 amu of the exact value then the Mass DAC values must be changed. Increasing the Mass DAC increases the measured mass value. This is done daily before sample analysis. Print the calibration and store with the daily performance check.

Note: Extreme care must be taken when adjusting DAC values. Instrument performance can be severely degraded if tuning parameters are not correct.

10.3.4.2 Open the Daily Performance workspace

10.3.4.2.1 Aspirate the Daily Performance Solution (10.17).

10.3.4.2.2 Click on "Analyze Sample" in the manual sample window.

10.3.4.2.3 Monitor daily performance measures as recommended by Perkin Elmer for Ba, Ce, Mg, Rh, Pb, In and U sensitivity, background, % double charged and % oxide levels.

10.3.4.2.4 See Manufacturer's recommendations for sensitivity. If criteria are not met then follow optimization procedures specified by the manufacturer.

10.3.4.2.5 The background at mass 220 should be < 30 cps.

10.3.4.2.6 The % double charged ions (Ba^{+}/Ba^{++}) should< 3% and not to exceed 5%.

10.3.4.2.7 The % oxides (Ce/CeO)should be < 3% and not to exceed 5%.

10.3.5 Open the appropriate analytical method. Turn on the autosampler and click on the "Sampling" icon in the Method. Select "Go to Rinse" at which point the sampling probe should go to the rinse station. Click on "OK". It may not be necessary to analyze for all the metals listed in the 6020A method. The analyte list can be edited down for only those metals required. Go to the Timing Page in the method and highlight the metals to be deleted. Go to the Edit Menu and select "delete rows". Save the method as a different name. For reporting purposes, the Report File Name on the Report Page of the 6020 Method or edited Method is saved under c:\elandata\dataset\dataset**LIMS WG#. etc.** for each analysis on that date.

10.3.6 Open the "Sample" window and click on batch analysis to update with new sample information.

10.3.7 Open the 6020TEMP sample file or a previously used file and edit the table with sample names, autosampler positions and dilutions. Select the Method for analysis and record all standard ID's and acids used in the Description Column of the Batch Analysis page. Save the file as a different name.

10.3.8 Calibrate the instrument using the calibration standards listed in Section 8.0, Reagents and Standards. The system must be flushed with a rinse blank sample (equivalent to the calibration blank) between each standard to protect against potential carry-over. The average intensity of 3 multiple exposures must be performed for QC samples and field samples to reduce random instrument error. The calibration curve consists of a blank and two to three standards.

10.3.9 The Calibration action for the first sample for which concentration results are desired must be "Analyze Blank, Standards, and Sample".

10.3.10 The calibration action for all other samples is usually "Analyze Sample", unless periodic re-calibration is desired.

10.3.11 Click on the "Dataset" Icon, go to the "File Menu" and click on "New". The dataset name is designated by **LIMS WG#.**

10.3.12 Select "Analyze Batch"

10.3.13 Flush the system with the rinse blank solution between samples. The rinse blank nitric acid concentration corresponds to the acid concentration in samples and standards (see 10.10). The DRCe, 10% nitric acid is always used in the rinse solution. The same time must be elapsed between CCVs and CCBs as is allowed between samples. Analyze the CCV and the CCB after each 10 samples and at the end of the analytical sequence.

10.3.14 The CRI (if required), ICSA, and ICSAB solutions must be analyzed at the beginning of an analytical run or once every 12 hours, whichever is more frequent.

The CRI analysis is not performed if a calibration standard is prepared at the reporting limit and included in the initial calibration curve and if not specifically requested by the client. The calibration curve must always meet the criteria for linearity ($r = 0.995$).

10.3.15 Analysis Review

Two forms are used to primary and secondary review the analysis. These are called the "ICP MS Checklist" and the "Blank Reporting Limit Checklist" and are shown below.

10.3.15.1 ICP MS Checklist

This analysis review form is used by the analyst and secondary reviewer to note passing/failing QC standards and to record any other comments as communication for reporting sample results.

10.3.15.2 Blank Reporting Limit Checklist

This analysis review form is used to set the sample reporting limit based on the batch preparation blank and to compare instrument blanks (ICB and CCB's) to instrument detection limits. Instrument blanks are compared to the limit of 3 times the IDL. Instrument blanks, which exceed the IDL limit, are recorded on the form and may require sample reanalysis or reporting limit elevation. This form is generated annually as IDL studies are completed.

10.3.16 Target analytes detected above the calibration range must be diluted and re-analyzed. See Section 9 for all Quality Control frequencies and criteria.

10.4 Continuing Calibration

See Section 9.4.

10.5 Preventive Maintenance

10.5.1 General cleaning tips for ICP-MS

10.5.1.1 Sampling and skimmer cones should be removed and cleaned on a weekly basis or more often under high usage. Remove the cones with the tool provided with the instrument and clean with 10% HCl, and rinse thoroughly with deionized water. Reinstall cones and perform XY alignment procedures after igniting the plasma and the instrument has warmed up for 30 minutes (see 14.4).

10.5.1.2 Peristaltic pump tubing must be inspected regularly for wear and changed if necessary. Sample and internal standard tubing should be changed after 8 hours of use. Rinse and drain tubing less often.

10.5.1.3 The aspiration chamber may be cleaned periodically using the sonication soap solution in the sonication bath for 0.5 hrs and rinsed with 10% HNO_3 and deionized water.

10.5.1.4 To clean the autolens, the vacuum must be turned off, the cover to the vacuum chamber removed and the autolens taken out. Clean with 10% HCl, dry

thoroughly and return to the chamber. The autolens may also be polished with a wire brush. Replace the cover and evacuate.

10.5.2 Electron multiplier voltages require periodic optimization if Daily Performance Standard criteria in Section 10.3.4.2 are not met (see Operators Manual).

11. Data Evaluation, Calculations and Reporting

11.1 All calculations necessary to convert raw data (ion counts/second) are performed by the ELAN software. The calculated quantities are selected by choosing the desired options in the Report Options screen. The default report option for the ELAN 6020 Method is 6020.rop.

11.2 All calculations performed in the ELAN software are based on the ratio of the analyte intensity (cps) to the internal standard intensity (cps). In all calculations where internal standards are used, the ratio of the analyte intensity to internal standard intensity is taken before any other calculation is performed. *Note: Method 6020 requires the use of internal standards.*

11.3 The metal results are calculated by the following equation:

Aqueous:

$$\text{Metal result in } \mu g/L = \frac{C \times B}{A} \times DF$$

where:

A = Initial sample volume in mL, typically 25 mL
B = Digestate final volume in mL, typically 25 mL
C = Concentration of sample from instrument read-out in µg/L
DF = Dilution Factor

Solid:

$$\text{Metal result in mg/Kg} = \frac{\frac{C \times B}{A} \times DF \times \frac{100}{DW}}{1000}$$

where:

A = Initial sample weight in grams, typically 1 gram
B = Digestate final volume in mL, typically 50 mL
C = Concentration of sample from instrument read-out in µg/L
DF = Dilution Factor
DW = Dry Weight

11.4 To calculate Hardness:

(Ca result (in mg/L) x 2.5) + (Mg result (in mg/L) x 4.12) = Hardness in mg/L

11.5 All metal results should be reported to three significant figures

11.6 The primary analyst does data entry into the LIMS system. The LIMS is "linked" to the instrument, so the analyst must choose the sample(s) and elements to be reported from that

analytical sequence. All associated preparation and instrumental QC samples and dilutions are also chosen. The laboratory generates two types of data packages from the LIMS: "Commercial" for routine projects, and "Full Deliverable" or "CLP-like" for fully data validated projects. A Commercial package consists of sample results and the associated method blank and LCS results. A Full Deliverable package includes all sample results, all preparation and instrumental QC results and the associated supporting raw data.

11.7 All solids including soils, sediments, and sludges must be reported on a dry-weight basis. Tissue results may be reported in wet-weight depending upon client request.

11.8 A secondary review is performed on all data.

11.9 If interferences on sample analysis resulting in false positive, false negative or biased results are suspected or have been determined, it may be possible to eliminate or minimize these interferences through use of the DRCe ICP MS equipped with a reaction cell. The reaction cell allows for the introduction of oxygen and ammonia to react with the analyte or the interfering ion.

11.9.1 Arsenic analysis

The ArCl interference (see section 4.2) on As at m/z of 75 can be removed by introducing oxygen into the reaction cell. Oxygen reacts with As to form AsO. This analyte is measured at m/z of 91 and is not affected by the ArCl interference. The internal standard used for this analysis is 300 µg/L In. The following conditions have been found to be suitable for analysis of As in seawater. Seawater is a source of high chloride concentration.

Analyte	Cell Gas	Flow Rate (ml/min)	RP_0	RP_q
As	Oxygen	0.6	0	0.75
In	Oxygen	0.6	0	0.85

Note: These conditions may change to optimize the analysis for a particular sample matrix.

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

Section 9 outlines sample batch QC acceptance criteria. If non-compliant metals results are to be reported, the Department Manager and/or the Laboratory Director must approve the reporting of these results. The laboratory Project Manager shall be notified, and may chose to relay the non-compliance to the client, for approval, or other corrective action, such as re-sampling and re-analysis. The analyst or Section Head performing the secondary review initiates the project narrative, and the narrative must clearly document the non-compliance and provide a reason for acceptance of these results.

13. Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the MDL, LOD, and/or LOQ as outlined in Alpha SOP/08-05. These studies performed by the laboratory are maintained on file for review.

13.2 Instrument Detection Limit

The instrument detection limit (IDL) is the smallest signal above the background noise that an instrument can detect. The IDLs can be calculated by multiplying by 3, the average standard deviations for measurements of a reagent blank analyzed on three analytical runs on three non-consecutive days. Seven consecutive measurements must be taken per day. The IDLs are not required to go through sample digestion. Each measurement must be performed as though it were a separate sample. The current IDLs are available upon request.

13.3 Demonstration of Capability Studies

Refer to Alpha SOP/08-12 for further information regarding IDC/DOC Generation.

13.3.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.3.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan

SOP/08-05 MDL/LOD/LOQ Generation

SOP/08-12 IDC/DOC Generation

SOP/14-01 Waste Management and Disposal SOP

16. Attachments

Table 1: Reporting Limits
Table 2: QC Acceptance Criteria
Table 3: Isotopes Monitored and Equations Used
Table 4: Initial Calibration Levels and ICV/CCV Concentrations
Table 5: ELAN 6100 and DRCe Linear Ranges for Method 6020A

Table 1 – Reporting Limits

Metal	Aqueous (µg/L)	Solid - Hot Plate (mg/Kg)	Tissue – Microwave (mg/Kg)
Aluminum	100	10	10
Antimony	0.5	0.05	0.05
Arsenic	0.5	0.05	0.1
Barium	0.5	0.05	0.05
Beryllium	0.5	0.02	0.05
Boron	10	0.5	0.5
Cadmium	0.2	0.02	0.02
Calcium	100	50	20
Chromium	0.5	0.2	0.05
Cobalt	0.2	0.02	0.05
Copper	0.5	0.1	0.05
Iron	50	20	10
Lead	1.0	0.05	0.02
Magnesium	50	10	10
Manganese	0.5	0.2	0.1
Molybdenum	0.5	0.05	0.05
Nickel	0.5	0.1	0.05
Potassium	200	10	10
Selenium	1.0	0.05	0.1
Silver	0.2	0.05	0.05
Sodium	100	10	10
Strontium	0.5	0.05	0.05
Thallium	0.2	0.02	0.02
Tin	0.5	5.0	0.10
Titanium	0.5	0.2	
Vanadium	5.0	0.1	0.1
Zinc	10	0.1	0.5

Table 2 – QC Acceptance Criteria

QC Parameter	Acceptance Criteria
Tuning Solution	≤ 5% RSD
Mass Calibration	Must not differ by more than 0.1 amu from true value
Resolution Checks	Less than 0.9 amu at 10% peak height
Initial Calibration Curve	R ≥ 0.995
Method Blank	< reporting limit
Laboratory Control Sample	80-120%R for aqueous and 75-125%R (or Manufacturer's control limits) for solid
Matrix Duplicate	≤ 20%RPD for results >5x reporting limit
Matrix Spike	75-125%R for solid and aqueous
Matrix Spike Duplicate (if requested)	75-125%R for solid and aqueous, and ≤20% RPD
Initial and Continuing Calibration Verification	90-110%R
Initial and Continuing Calibration Blank	± 3X IDL
CRI (Reporting Limit Check)	50-150%R (DoD = 80-120%R)
ICSA and ICSAB Solution	80-120%R for spiked analytes
Internal Standard	70-120%R (Method 6020A) for instrument QC samples and field samples
Serial Dilution Sample	<10% D
Post Digestion Spike	75-125%R

Table 3 - Isotopes Monitored and Equations Used

1.1.1.1 1.1.1.2 Analyte	Symbol	Isotopes Monitored	1.1.1.3 1.1.1.4 Correction Equations
Aluminum	Al	27	
Antimony	Sb	121,123	Sb 123 = Sb 123 - 0.127189 * Te 125
Arsenic	As	75	As 75 = As 75 - 3.127 * [ArCl 77 - (0.815*Se 82)]
Barium	Ba	135,137	
Beryllium	Be	9	
Cadmium	Cd	106,108,111,114	Cd 111 = Cd 111 - 1.073 * [MoO 108 -(0.712*Pd 106)] Cd 114 = Cd 114 - 0.026826 * Sn 118
Chromium	Cr	52,53	
Calcium	Ca	44	
Cobalt	Co	59	
Copper	Cu	63,65	
Iron	Fe	54	Fe 54 = Fe 54 - 0.028226 * Cr 52
Lead	Pb	206,207,208	Pb 208 = Pb 208 + 1* Pb 206 + 1* Pb 207
Calcium	Ca	44	
Manganese	Mn	55	
Molybdenum	Mo	95,97,98	Mo 98= Mo 98 - 0.110588 * Ru 101
Nickel	Ni	60,62	
Potassium	K	39	
Selenium	Se	77,82	Se 82 = Se 82 - 1.008696 * Kr 83
Silver	Ag	107,109	
Sodium	Na	23	
Thallium	Tl	203,205	
Vanadium	V	51	V 51 = V 51 - 3.127*[ClO 53 - (0.113*Cr 52)]
Zinc	Zn	66,67,68	
1.1.1.4.1 Internal Standards			
Lithium	Li	6	
Scandium	Sc	45	
Germanium	Ge	74	
Yttrium	Y	89	
Rhodium	Rh	103	
Indium	In	115	
Terbium	Tb	159	
Bismuth	Bi	209	

Table 4 - Initial Calibration Levels and ICV/CCV Concentrations

Analyte	STD1	STD2	STD3	STD4	STD5	ICV,CCV
	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)	(µg/L)
Ag	0.10				100	50
Al	10.1	110	1020	10050		5050
As	0.10	10	20	100		50
B	0.10	10	20	100		50
Ba	0.10				100	50
Be	0.10	10	20	100		50
Ca	10.1	110	1020	10100		5050
Cd	0.10	10	20	100		50
Co	0.10	10	20	100		50
Cr	0.10	10	20	100		50
Cu	0.10	10	20	100		50
Fe	10.1	110	1020	10100		5050
K	11.0	100	1000	10000		5500
Mg	10.1	110	1020	10100		5050
Mn	0.10	10	20	100		50
Mo	0.10	10	20	100		50
Na	10.1	100	1000	10000		5050
Ni	0.10	10	20	100		50
Pb	0.10	10	20	100		50
Sb	0.10	10	20	100		50
Se	0.10	10	20	100		50
Si	0.05	5	10	50		25
Sn	0.10	10	20	100		50
Sr	0.10	10	20	100		50
Ti	0.10	10	20	100		50
Tl	0.10	10	20	100		50
V	0.10	10	20	100		50
Zn	0.10	10	20	100		50

Table 5 - ELAN 6100 and DRCe Linear Ranges for Method 6020A.

Analyte	Mass	Linear Range (mg/L)
Ag	107	5
Al	27	50
As	75	5
B	11	5
Ba	138	5
Be	9	5
Ca	44	50
Cd	114	5
Co	59	5
Cr	52	5
Cu	63	5
Fe	57	50
K	39	50
Mg	24	50
Mn	55	5
Mo	98	5
Na	23	50
Ni	60	50
Pb	208	5
Sb	121	5
Se	82	5
Si	28	5
Ti	48	5
Tl	205	5
V	51	5
Zn	66	5

Microwave Assisted Acid Digestion of Sediments, Soils, and Tissues

References: **Method 3051A,** *Test Methods for the Evaluation of Solid Wastes*, (USEPA Office of Solid Waste and Emergency Response), SW-846, Method 3051A, Rev. 1, Nov. 1998

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Edited signatories.

Microwave Assisted Acid Digestion of Sediments, Soils, and Tissues

References: **Method 3051A,** *Test Methods for the Evaluation of Solid Wastes*, (USEPA Office of Solid Waste and Emergency Response), SW-846, Method 3051A, Rev. 1, Nov. 1998

1. Scope and Application

Matrices: This method is applicable to the microwave-assisted acid extraction/dissolution of sediments, soils and tissue samples.

Definitions: Refer to Alpha Analytical Quality Manual.

This microwave extraction method is designed to mimic extraction using conventional heating with nitric acid (HNO_3), or alternatively, nitric acid and hydrochloric acid (HCl), according to EPA Methods 200.2, 3010, and 3050. Since these methods are not intended to accomplish total decomposition of the sample, the extracted analyte concentrations may not reflect the total content in the sample. This method is applicable to the microwave-assisted acid extraction/dissolution[1] of sediments, soils and tissue samples for the elements listed below.

This method is provided as an alternative to EPA Method 3050. This method provides options for improving the performance for certain analytes, such as antimony, iron, aluminum, and silver by the addition of hydrochloric acid, when necessary. It is intended to provide a rapid multi-element acid extraction or dissolution prior to analysis so that decisions can be made about materials and site cleanup levels, the need for TCLP testing of a waste (see EPA Method 1311, Section 1.2, for further details), and whether a BDAT process is providing acceptable performance. Digests produced by the method are suitable for analysis by flame atomic absorption spectrophotometry (FLAA), graphite furnace atomic absorption spectrophotometry (GFAA), inductively coupled plasma atomic emission spectrometry (ICP-AES) and inductively coupled plasma mass spectrometry (ICP-MS). However, the addition of HCl may limit the methods of detection, or increase the difficulties of detection with some techniques.

Due to the rapid advances in microwave technology, consult your manufacturer's recommended instructions for guidance on their microwave digestion system.

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of experienced analysts. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability, analyzing a proficiency test sample and completing the record of training.

After initial demonstration, ongoing demonstration is based on acceptable laboratory performance of at least a quarterly laboratory control sample or acceptable performance from an annual proficiency test sample. A major modification to this procedure requires demonstration of performance. The identification of major method modification requiring performance demonstration is directed by the Quality Assurance Officer and/or Laboratory Director on a case-by-case basis.

Parameter	CAS	Parameter	CAS
Aluminum (Al)	7429-90-5	Magnesium (Mg)	7439-95-4
Antimony (Sb)	7440-36-0	Manganese (Mn)	7439-96-5
Arsenic (As)	7440-38-2	Mercury (Hg)	7439-97-6
Barium (Ba)	7440-39-3	Molybdenum (Mo)	7439-98-7
Beryllium (Be)	7440-41-7	Nickel (Ni)	7440-02-0
Boron (B)	7440-42-8	Potassium (K)	7440-09-7
Cadmium (Cd)	7440-43-9	Selenium (Se)	7782-49-2
Calcium (Ca)	7440-70-2	Silver (Ag)	7440-22-4
Chromium (Cr)	7440-47-3	Sodium (Na)	7440-23-5
Cobalt (Co)	7440-48-4	Strontium (Sr)	7440-24-6
Copper (Cu)	7440-50-8	Thallium (Tl)	7440-28-0
Iron (Fe)	7439-89-6	Vanadium (V)	7440-62-2
Lead (Pb)	7439-92-1	Zinc (Zn)	7440-66-6

2. Summary of Method

For soils, sediments and tissues, a representative sample of 0.5-1.5 g is extracted and/or dissolved in 10mL concentrated nitric acid for 10 minutes using microwave heating with a suitable laboratory microwave unit. The sample and acid(s) are placed in a fluorocarbon polymer (PFA or TFM) or quartz microwave vessel or vessel liner. The vessel is sealed and heated in the microwave unit. After cooling, the vessel contents are filtered, centrifuged, or allowed to settle and then diluted to volume and analyzed by the appropriate determinative method.

2.1 Method Modifications from Reference

None.

3. Reporting Limits

Refer to the appropriate analytical SOP for reporting limit information.

4. Interferences

4.1 Very reactive samples or volatile materials may create high pressures due to the evolution of gaseous digestion products. This may cause venting of the vessels with potential loss of sample and/or analytes. The complete decomposition of either carbonates, or carbon based samples, may produce enough pressure to vent the vessel if the soil sample size is greater than 0.25 g (depending on the pressure capability of the vessel). Variations of the method to accommodate very reactive materials are specifically addressed in Section 10.3.1.3.

4.2 Many types of samples will be dissolved by this method. A few refractory sample matrix compounds, such as quartz, silicates, titanium dioxide, alumina, and other oxides may not be dissolved and in some cases may sequester target analyte elements. These bound elements are considered non-mobile in the environment and are excluded from most aqueous transport mechanisms of pollution.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

5.1 The microwave unit cavity must be corrosion resistant and well ventilated. All electronics must be protected against corrosion for safe operation. Never use an Advanced Composite Vessel without a composite sleeve. Prior to use, all vessel components must be dry and free of particulate matter. Drops of liquid or particles will absorb microwave energy that can lead to localized charring which can lead to vessel damage or failure. Never install more than one rupture membrane in an Advanced Composite Vessel.

CAUTION: There are many safety and operational recommendations specific to the model and manufacturer of the microwave equipment. The analyst is advised to consult the equipment manual (see 1.3), the equipment manufacturer, and other appropriate literature for proper and safe operation of the microwave equipment and vessels.

5.2 The method requires essentially microwave transparent and reagent resistant materials such as fluorocarbon polymers (examples are PFA or TFM) or quartz to contain acids and samples. For higher pressure capabilities the vessel may be contained within layers of different microwave transparent materials for strength, durability, and safety. The internal volume of the vessel should be at least 45mL, and the vessel must be capable of withstanding pressures of 200psi, and capable of controlled pressure relief. These specifications are to provide an appropriate, safe, and durable reaction vessel of which there are many adequate designs by many suppliers. CEM provides 100mL vessels made of Teflon PFA, caps made of Ultem polyetherimide (reinforced), and sleeves of composite glass, Teflon PFA and Ultem.

5.3 ***CAUTION:*** The reagent combination (9mL nitric acid to 3mL hydrochloric acid) results in greater pressures than those resulting from the use of only nitric acid. Pressures of approximately 12atm have been reached during the heating of the acid mixture alone (no sample in the vessel). Pressures reached during the actual decomposition of a sediment sample (with low organic content) have more than doubled when using the 9mL nitric and 3mL hydrochloric acid mixture. These higher pressures may necessitate the use of vessels having higher pressure capabilities. Matrices having large organic content, such as oils, can produce approximately 25atm of pressure inside the vessel (as described in EPA Method 3052).

5.4 ***CAUTION:*** Another safety concern relates to the use of sealed containers without pressure relief devices. Temperature is the important variable controlling the reaction. Pressure is needed to attain elevated temperatures, but must be safely contained. Some digestion vessels constructed from certain fluorocarbons may crack, burst, or explode in the unit under certain pressures. Only fluorocarbon (such as PFA or TFM and others) or quartz containers with pressure relief mechanisms or containers with fluorocarbon or quartz liners and pressure relief mechanisms are considered acceptable.

5.5 ***CAUTION:*** Laboratories should NOT use domestic (kitchen) type microwave ovens for this method because of significant safety issues. When acids such as nitric and hydrochloric are used to effect sample digestion in microwave units in open vessel(s), or sealed vessel(s),

there is the potential for any released acid vapors to corrode the safety devices that prevent the microwave magnetron from shutting off when the door is opened. This can result in operator exposure to microwave energy. Use of a system with isolated and corrosion resistant safety devices prevents this from occurring.

5.6 Users are therefore advised NOT to use domestic (kitchen) type microwave ovens or sealed containers which are not equipped with controlled pressure relief mechanisms for microwave acid digestions by this method. Use of laboratory-grade microwave equipment is required to prevent safety hazards.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

All samples must have been collected using a sampling plan that addresses the considerations discussed in Chapter Nine of SW-846. Refer to that chapter, as updated, for guidance.

All sample containers must be pre-cleaned by the vendor. Plastic and glass containers are both suitable. For further information, see Chapter Three of SW-846.

6.2 Sample Preservation

No preservatives are used.

6.3 Sample Shipping

No special shipping requirements. Typical shipping procedures may be found in the Alpha's Sample Receipt and Log-In SOP (01-01).

6.4 Sample Handling

Samples should be refrigerated upon receipt (4°C ± 2) or frozen at -20°C ± 10°C.

7. Equipment and Supplies

7.1 **Microwave apparatus:** Milestone Ethos E 1000 W Microwave Oven with maximum operating temperature of 200°C and maximum operating pressure of 200 PSIG/13.8 Bar.

7.1.1 The temperature performance requirements necessitate the microwave decomposition system to sense the temperature to be within ± 2.5° C and automatically adjust the microwave field output power within 2 seconds of sensing. Temperature sensors should be accurate to ± 2.5° C (including the final reaction temperature of the digestion procedure). Temperature feedback control provides the primary performance mechanism for the method. Due to the variability in sample matrix types and microwave digestion equipment (i.e., different vessel types and microwave oven designs), temperature feedback control is preferred for reproducible microwave heating.

7.1.2 Alternatively, for a specific vessel type, specific set of reagent(s), and sample type, a calibration control mechanism can be developed. Through calibration of the microwave power for a specific number and type of vessels, vessel load, and heat loss characteristics of a specific vessel series, the reaction temperature profile described in Sec. 11.3.5 can be reproduced. The calibration settings are specific for the number and type of vessels and microwave system being used, in addition to the specific reagent combination being used. Therefore, no specific calibration settings are provided in this method. These settings may be developed by using temperature monitoring equipment for each specific set of microwave equipment and vessel type. In this circumstance, the microwave system provides programmable power, which can be programmed to within ± 12

W of the required power. Typical systems provide a nominal 600 W to 1200 W of power. Calibration control provides backward compatibility with older laboratory microwave systems which may not be equipped for temperature monitoring or feedback control and with lower cost microwave systems for some repetitive analyses. Older vessels with lower pressure capabilities may not be compatible.

7.1.3 A rotating turntable is employed to ensure the homogeneous distribution of microwave radiation within the unit. The speed of the turntable should be a minimum of 3 rpm. Other types of equipment that are used to assist in achieving uniformity of the microwave field may also be appropriate.

7.1.4 Milestone Fiber Optic Temperature Probe Part # FO00110

7.2 **Mechanical Pipette:** Class A or appropriate

7.3 **Volumetric Graduated Cylinder:** Class A or appropriate, 50 or 100mL capacity or equivalent.

7.4 **Filter paper**, qualitative or equivalent

7.5 **Filter funnel**, glass, polypropylene, or other appropriate material

7.6 **Balance:** Top loading balance capable of reading two decimal places

7.7 **Spatulas**

7.8 **Digestion Tubes:** Pre-cleaned, graduated, disposable tubes, 50 mL volume (Environmental Express part # SC475 or equivalent) with Filter Assembly (Environmental Express Part # SC0408 or equivalent). The 50mL volume of each Lot of tubes is verified and documented in a logbook (Form No.: 105-02).

8. Reagents and Standards

All acids should be sub-boiling-distilled where possible to minimize the blank levels due to metallic contamination. Other grades may be used, provided it is first ascertained that the reagent is of sufficient purity to permit its use without decreasing the accuracy of the determination. If the purity of a reagent is questionable, the reagent should be analyzed to determine the level of impurities. The reagent blank must be less than the RL in order to be used. The expiration date of all reagents and standards is six months unless otherwise noted. Reagents and standards are stored at room temperature.

8.1 **Concentrated nitric acid (HNO_3).** Prior to use, the acid is analyzed to determine levels of impurity. If the method blank is less than the RL, the acid can be used. Results of this analysis are kept in a logbook.

8.2 **Concentrated hydrochloric acid (HCl).** Prior to use, the acid ise analyzed to determine levels of impurity. If the method blank is less than the RL, the acid can be used. Results of this analysis are kept in a logbook.

8.3 **Reagent Grade Deionized Water (DI):** Reagent water shall be interference free. All references to water in the method refer to reagent grade DI water unless otherwise specified.

8.4 Spiking solutions:

8.4.1 **Laboratory Control Sample (LCS) and High Matrix Spiking (MS) solution for 3051:** Spike 0.5mL of S1 into the LCS and MS samples. The final concentration in the LCS and MS samples are Be and Cd at 0.5mg/L; Sb, Ba, B, Cr, Cu, Co,

Mn, Zn, Ni, Pb, V, Tl, As, Se and Mo at 1.0mg/L; Al, Ca, Fe, Mg, K, and Na at 5.0mg/L

8.4.1.1 S1 Solution: Prepare by adding 5mL of concentrated HNO_3 to a 100mL volumetric flask using a 5mL glass pipette. Then add 10mL of ICUS-624 (Ultra Scientific) solution containing Be and Cd at 500mg/L, for a concentration of 50mg/L, and Sb, Ba, B, Cr, Cu, Co, Mn, and Mo at 1000mg/L, for a concentration of 100mg/L. Next add 10mL of ICUS-625 (Ultra Scientific) solution containing Zn, Ni, Pb and V at 1000mg/L for a concentration of 100mg/L, and Al, Ca, Fe, Mg, K, and Na at 5000mg/L, for a concentration of 500mg/L. Next add 10mL each of Tl, As and Se (SPEX) at 1,000mg/L for a concentration of 100mg/L. This solution is brought to volume with DI water

8.4.2 Laboratory Control Sample (LCS) and Low Matrix Spiking (MS) solution for 3051: Spike 0.80mL of S3 into the LCS sample and MS sample.

8.4.2.1 S3 Solution: Prepare by adding 5mL of concentrated HNO_3 to a 100mL volumetric flask using a 5mL glass pipette. Then add 2.5mL of IQC-026 (Ultra Scientific) Elements solution containing Ag, Al, As, Ba, Be, B, Ca, Cd, Cr, Cu, Co, Fe, Pb, Mg, Mn, Mo, Ni, Sb, Se, Tl, Ti, V, and Zn at 100mg/L. Si is present at 50 mg/L and K is present at 1000 mg/L for a concentration of 2.5mg/L for all elements except Si (1.25 mg/L) and K (25 mg/L). This solution is brought to volume with DI water.

8.4.2.2 Hg solution: Prepare by diluting the 1000 mg/L stock standard 1:50 in 2% HCl. Add 0.1 mL of stock to 100 ml volumetric flask and bring to volume to make a 1.0 mg/L solution. Add 1.25mL of 1.0mg/L Hg to LCS and matrix spike low standards

Note: The mercury spike concentration may be reduced if lower reporting limits are required. The spike volume used for plant tissue is 0.025 mL.

8.5 Blank Sand: Catalog #058 from Environmental Resource Associates (ERA)

8.6 Solid Matrix Sample: Catalog # 540 from ERA

9 Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank

A blank must be processed with each analytical batch or every 20 samples whichever is more frequent. A blank is brought through the whole sample preparation and analysis process. All measured analyte concentrations in the preparation blank must be below the reporting limit. Analysis according to the appropriate analytical SOP may be repeated once to see if an analytical error has occurred. The batch should be re-prepared for any analyte whose concentration exceeds the reporting limit. A blank whose analyte concentrations exceed the reporting limit may be deemed acceptable by the Metals Supervisor if analyte concentration in the affected sample are below the reporting limit or greater than ten times the reporting limit.

If required, and a blank solid material of a similar matrix type (Environmental Resource Associates #058 or equivalent) of high enough purity can be obtained to meet required

reporting limits, a solid material may be used in the Method Blank preparation to matrix match QC samples and field samples.

9.2 Laboratory Control Sample (LCS)

A LCS is processed with each analytical batch or every 20 samples whichever is more frequent. A LCS is a blank spike brought through the whole sample preparation and analysis process. Nominal recovery limits for an LCS are 80% - 120%. Analysis according to the appropriate analytical SOP may be repeated once to see if an analytical error has occurred. The batch should be re-prepared for any analyte whose recovery is outside of these limits. The Metals Supervisor may deem an LCS whose recovery for any analyte is outside of these limits acceptable if acceptable recoveries from a matrix spike and/or SRM prepared with the batch are within control limits.

If required, a solid LCS (Environmental Resources Associates # 544 or equivalent) may be prepared to matrix match QC samples and field samples.

9.3 Initial Calibration Verification (ICV)

Not Applicable

9.4 Continuing Calibration Verification (CCV

Not Applicable

9.5 Matrix Spike

Spiked samples (MS) or standard reference materials should be included with each group of samples processed, or every 20 samples whichever is more frequent. A spiked sample should also be included whenever a new sample matrix is being analyzed. An SRM is used when required by the project.

9.6 Laboratory Duplicate

Duplicate samples should be processed on a routine basis. A duplicate sample is a sample brought through the whole sample preparation and analysis process. A duplicate sample must be processed with each analytical batch or every 20 samples whichever is more frequent. A duplicate sample should be prepared for each matrix type (i.e., soil, sludge, etc.).

9.7 Method-specific Quality Control Samples

9.8 Method Sequence

- Method Blank
- Laboratory Control Sample
- Laboratory Duplicate
- Matrix Spike
- Samples 1-20

10 Procedure

10.1 Equipment Set-up

10.1.1 Temperature control of closed vessel microwave instruments provides the main feedback control performance mechanism for the method. Method control requires a temperature sensor in one or more vessels during the entire decomposition. The microwave decomposition system should sense the temperature to within ± 2.5 °C and permit adjustment of the microwave output power within 2 seconds.

10.1.2 All digestion vessels and volumetric ware must be carefully acid washed and rinsed with DI water. For normal cleaning, vessels are rinsed with DI water and soaked in DI water overnight. They are then assembled, 10 ml concentrated HNO_3 is added and digested using the method program. They are then rinsed with DI water and dried in a clean environment. When switching between high concentration samples and low concentration samples, all digestion vessels (fluoropolymer or quartz liners) should be thoroughly cleaned using the procedure above, visually inspected, and checked for contamination by the analysis of a preparation blank. This cleaning procedure should also be used whenever the prior use of the digestion vessels is unknown or cross contamination from prior sample digestions in vessels is suspected.

10.2 Initial Calibration

Not applicable

10.3 Equipment Operation and Sample Processing

10.3.1 Sample Digestion

10.3.1.1 For soil, sediment and tissue samples, weigh a well-mixed sample to the nearest 0.01 g into an appropriate vessel equipped with a controlled pressure relief mechanism. For soils, sediments, and tissues use 0.5-1.5 g .If the sample can not be well mixed and homogenized on an as-received basis, then air or oven drying at 60°C or less, crushing, sieving, grinding, and mixing should be performed as necessary to homogenize the sample until the subsampling variance is less than the data quality objectives of the analysis. While proper sample preparation generally produces great reduction in analytical variability, be aware that in certain unusual circumstances there could be loss of volatile metals (e.g., Hg, organometallics) or irreversible chemical changes (e.g., precipitation of insoluble species, change in valence state). See Chapter Three of SW-846 for more details.

10.3.1.2 For soil, sediment and tissue samples, add 10mL ± 0.1mL concentrated nitric acid to the vessel in a fume hood (or fume exhausted enclosure). The addition of concentrated hydrochloric acid to the nitric acid is appropriate for the stabilization of certain analytes, such as Ag, Ba, and Sb and high concentrations of Fe and Al in solution. The addition of hydrochloric acid may, however, limit the detection techniques or increase the difficulties of analysis for some detection systems such as ICP-MS (Method 6020) or GFAA (Method 7000). Samples are predigested for 10-120 minutes under a hood with the vessels loosely capped to allow gases to escape.

CAUTION: The addition of hydrochloric acid must be in the form of concentrated hydrochloric acid and not from a premixed combination of acids as a buildup of chlorine gas, as well as other gases, will result from a premixed acid solution. These gases may be violently released upon heating. This is avoided by adding the acid in the described manner.

CAUTION: Toxic nitrogen oxide(s) and chlorine fumes are usually produced during digestion. Therefore, all steps involving open or the opening of microwave vessels must be performed in a properly operating fume ventilation system.

CAUTION: The analyst should wear protective gloves and face protection.

CAUTION: The use of microwave equipment with temperature feedback control is required to control any unfamiliar reactions that may occur during the leaching of samples of unknown composition. The leaching of these samples may require additional vessel requirements such as increased pressure capabilities

10.3.1.3 The analyst should be aware of the potential for a vigorous reaction, especially with samples containing volatile or easily oxidized organic species. When digesting a matrix of this type, initially use no more than 0.100 g of sample. If a vigorous reaction occurs upon the addition of reagent(s), allow the sample to predigest in the uncapped digestion vessel until the reaction ceases. Heat may be added in this step for safety considerations (for example, the rapid release of carbon dioxide from carbonates, easily oxidized organic matter, etc.). Once the initial reaction has ceased, the sample may continue through the digestion procedure. However, if no appreciable reaction occurs, a sample mass of 0.250 g for oils, or 0.10-5 g for soil, sediments or tissues may be used.

10.3.1.4 Seal the vessel according to the manufacturer's directions. Properly place the vessel in the microwave system according to the manufacturer's recommended specifications and, when applicable, connect appropriate temperature and pressure sensors to vessels according to manufacturer's specifications.

10.3.1.5 This method is a performance based method, designed to achieve or approach consistent leaching of the sample through achieving specific reaction conditions. For soil, sediment and tissue samples, the temperature of each sample should rise to 175 ± 5 °C in approximately 5 minutes and remain at 175 ± 5°C for the remainder of the 10 minutes digestion period. When using temperature feedback control, the number of samples that may be simultaneously digested may vary, from one sample up to the maximum number of vessels that can be heated by the magnetron of the microwave unit according to the heating profile specified previously in this section. (The number will depend on the power of the unit, the number of vessels, and the heat loss from the vessels). If vessel rupture is observed in soil sample digestion, the temperature may be reduced to 150 °C.

NOTE: The pressure should peak between 5 and 10 minutes for most soil, sediment and tissue samples. If the pressure exceeds the pressure limits of the vessel, the pressure should be safely and controllably reduced by the pressure relief mechanism of the vessel.

10.3.1.5.1 Calibration control is applicable in reproducing this method provided the power in watts versus time parameters are determined to reproduce the specifications listed in 11.3.5. The calibration settings will be specific to the quantity of reagents, the number of vessels, and the heat loss characteristics of the vessels. If calibration control is being used, any vessels containing acids for analytical blank purposes are counted as sample vessels. When fewer than the recommended number of samples are to be digested, the remaining vessels should be filled with the same acid mixture to achieve the full complement of vessels. This provides an energy balance, since the microwave power absorbed is proportional to the total absorbing mass in the cavity. Irradiate each group of vessels using the predetermined calibration settings. (Different vessel types should not be mixed).

10.3.1.6 At the end of the microwave program, allow the vessels to cool for a minimum of 5 minutes before removing them from the microwave system. Cooling of the vessels may be accelerated by internal or external cooling devices. When the vessels have cooled to near room temperature, determine if the microwave vessels have maintained their seal throughout the digestion. Due to the wide variability of vessel designs, a single procedure is not appropriate. For vessels that are sealed as discrete separate entities, the vessel weight may be taken before and after digestion to evaluate seal integrity. If the weight loss of sample exceeds 10% of the weight of the sample and reagents, then the sample is considered compromised. For vessels with burst disks, a careful visual inspection

of the disk, in addition to weighing, may identify compromised vessels. For vessels with resealing pressure relief mechanisms, an auditory or a physical sign that can indicate whether a vessel has vented is appropriate.

Samples must be weighed before and after digestion on a top loading balance capable of reading to 0.01 g. The combined weights of sample plus reagents should lose no more than 10% of the intial mass. If the weight loss exceeds the 10% limit, the sample digest should be considered compromised and re-prepared. Weight loss records will be maintained in the digestion log book along with each sample preparation.

10.3.1.7 Complete the preparation of the sample by carefully uncapping and venting each vessel in a chemical fume hood (or fume exhausted enclosure). Vent the vessels using the procedure recommended by the vessel manufacturer. Quantitatively transfer the sample to a clean vial and bring to 50 mL final volume with DI water. If the digested sample contains particulates that may clog nebulizers or interfere with injection of the sample into the instrument, the sample may be, allowed to settle (11.3.7.1), or filtered (11.3.7.2).

10.3.1.7.1 Settling: If undissolved material, such as SiO_2, TiO_2, or other refractory oxides, remains, allow the sample to stand until the supernatant is clear. Allowing a sample to stand overnight will usually accomplish this. If it does not, centrifuge or filter the sample.

10.3.1.7.2 Filtering: Samples may be filtered in the 50 mL sample vial using a filter assembly (See Section 7.8). If necessary, a filtering apparatus may be used after thoroughly cleaning and rinsing with dilute (approximately 10% V/V) nitric acid. Filter the sample through qualitative filter paper into a second acid-cleaned container.

10.4 Continuing Calibration

Not applicable.

10.5 Preventive Maintenance

10.5.1 Schedule annual maintenance with instrument a service company.

10.5.2 The accuracy of the temperature measurement system should be validated prior to use of a new probe and annually. This can be done using oil and an external calibrated temperature measurement system. The solution should be adequately stirred to ensure a homogeneous temperature, and both the microwave temperature sensor and the external temperature sensor placed into the oil. The temperature between the probe and external temperature measurement system should be compared at several different temperatures from room temperature to approximately 100 °C. If the measured temperatures vary by more than 2.5 °C, the microwave temperature measurement system should be calibrated or the probe should be replaced. Consult the microwave manufacturer's instructions about the specific calibration procedure for the temperature sensor. Results are maintained in the Microwave Probe Temperature Calibration Log.

10.5.3 Visually inspect digestion vessels for signs of wear.

11 Data Evaluation, Calculations and Reporting

11.1 For soil, sediment and tissue samples, calculate the sample dry-weight fraction as follows:

$$\text{Dry-Wt fraction} = \frac{W_2 - W_3}{W_1 - W_3}$$

Where:

W_1 = Wt for sample + vessel, before drying, g
W_2 = Wt for sample + vessel, after drying, g
W_3 = Wt for empty, dry vessel, g

11.2 Convert the soil, sediment and tissue extract concentrations obtained from the instrument in mg/L to mg/kg dry-weight of sample by

$$\text{Sample concentration} = \frac{(C)(V)(D)}{(W)(S)}$$

Where:

C = Concentration in extract (mg/L)
D = Dilution factor
S = Solid dry-weight fraction for sample, g/g
V = Volume of extract, mL x 0.001
W = Weight of undried sample extracted, g x 0.001

12 Contingencies for Handling Out-of-Control Data or Unacceptable Data

Section 9 and the appropriate analytical SOPs outline sample batch QC acceptance criteria. If non-compliant inorganic element results are to be reported, the Metals Section Head and/or the Laboratory Director, and the QA Manager must approve the reporting of these results. The laboratory Project Manager shall be notified, and may chose to relay the non-compliance to the client, for approval, or other corrective action, such as re-sampling and re-analysis. The instrument analyst or Section Head performing the secondary analytical review initiates the project narrative, and the narrative must clearly document the non-compliance and provide a reason for acceptance of these results.

13 Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the MDL, LOD, and/or LOQ as outlined in Alpha SOP/08-05. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP/08-12 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14 Pollution Prevention and Waste Management

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15 Referenced Documents

Chemical Hygiene Plan

SOP/01-01 Sample Receipt & Log-In

SOP/08-05 MDL/LOD/LOQ Generation

SOP/08-12 IDC/DOC Generation

SOP/14-01 Waste Management and Disposal SOP

16 Attachments

None.

Acid Digestion of Aqueous Samples for Metals Analysis

References: **Method 3020A**, Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by GFAA Spectroscopy, USEPA, Test Methods for Evaluating Solid Waste, SW-846, Third Edition, July 1992 (Revision 1) as promulgated in the Final Update, December 1996.

Copy No.: _____ **Uncontrolled Document**

Authorized by:

Name: John Kowalski Position: Metals Department Manager

Signature: _____ Date: 8/17/11

Name: Joseph Watkins Position: Laboratory/Technical Director

Signature: _____ Date: 8/17/11

ISSUE AMENDMENTS

Changes since last issue:

Sections 6.3, 6.4 and 10.1: Removed references to outdated SOP, G-005

Section 10.1: Corrected section reference.

Corrected document footer.

Acid Digestion of Aqueous Samples for Metals Analysis

References: **Method 3020A**, Acid Digestion of Aqueous Samples and Extracts for Total Metals for Analysis by GFAA Spectroscopy, USEPA, Test Methods for Evaluating Solid Waste, SW-846, Third Edition, July 1992 (Revision 1) as promulgated in the Final Update, December 1996.

1. Scope and Application

Matrices: The method is applicable to groundwater, wastewater and surface water.

Definitions: Refer to Alpha Analytical Quality Manual.

Method 3020A

This acid digestion procedure is used to prepare aqueous samples for analysis by GFAA or ICP-MS. Samples prepared by this method may be analyzed by GFAA or ICP-MS for all the metals listed below:

Element	CASRN	Element	CASRN	Element	CASRN
Aluminum (Al)	7429-90-5	Cobalt (Co)	7440-48-4	Potassium (K)	7440-09-7
Antimony (Sb)	7440-36-0	Copper (Cu)	7440-50-8	Silver (Ag)	7440-22-4
Arsenic (As)	7440-38-2	Iron (Fe)	7439-89-6	Selenium (Se)	7782-49-2
Barium (Ba)	7440-39-3	Lead (Pb)	7439-92-1	Sodium (Na)	7440-23-5
Beryllium (Be)	7440-41-7	Magnesium (Mg)	7439-95-4	Thallium (Tl)	7440-28-0
Cadmium (Cd)	7440-43-9	Manganese (Mn)	7439-96-5	Tin (Sn)	7440-31-5
Calcium (Ca)	7440-70-2	Molybdenum (Mo)	7439-98-7	Titanium (Ti)	7440-32-6
Chromium (Cr)	7440-47-3	Nickel (Ni)	7440-02-0	Vanadium (V)	7440-62-2
				Zinc (Zn)	7440-66-6

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of trained analysts. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability, analyzing a proficiency test sample and completing the record of training.

After initial demonstration, ongoing demonstration is based on acceptable laboratory performance of at least a quarterly laboratory control sample or acceptable performance from an annual proficiency test sample. A major modification to this procedure requires demonstration of performance. The identification of major method modification requiring performance demonstration is directed by the Quality Assurance Officer and/or Laboratory Director on a case-by-case basis.

2. Summary of Method

- Method 3020A

0.75mL of concentrated nitric acid is added to 25mL of aqueous sample measured into a disposable digestion tube. The sample is heated in a block at 90-100°C and evaporated to approximately 5mL. 0.75mL of additional concentrated nitric acid is added, and the sample is refluxed for approximately 15 minutes, then evaporated to approximately 5 – 10 mL. After cooling, the sample is diluted back to 25mL, the initial sample volume, with deionized water.

If the sample should go to dryness, the sample must be re-prepared.

Some samples may require filtration due to insoluble silicates and the formation of precipitates during digestion. If this is the case, a filter blank must be added to the sample batch.

Samples received for dissolved metals (filtered through 0.45 µm filter) do not require digestion and are analyzed as-received. If filtration is performed in the laboratory, this is documented in the *Metals Filtration Logbook*, and a filter blank is prepared and analyzed with the sample batch.

2.1 Method Modifications from Reference

Method 3020A: The final volume has been reduced from 100mL to 25mL and reagent volumes have been proportionately reduced. Elements have been added to the analyte list as compared to the reference method.

3. Reporting Limits

Refer to the appropriate analytical SOP for reporting limit information.

4. Interferences

All re-usable glassware or plastic must be acid cleaned prior to use to remove residual trace elements.

Based on historical information, or by sample observation, it may be noted that some samples will require filtration after digestion, and prior to analysis, due to insoluble silicates and the formation of precipitates. If this is the case, a filter blank must be prepared for the batch. If the formation of precipitates is noted after sample digestion, and no filter blank was initiated, the associated method blank and laboratory control sample must be filtered.

5. Health and Safety

5.1 The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound must be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material data handling sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

5.2 All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

5.3 The use of laboratory equipment and chemicals exposes the analyst to several potential hazards. Good laboratory techniques and safety practices shall be followed at all times. Eating, drinking, smoking, or the application of cosmetics is not permitted in the laboratory area. Horseplay of any kind is prohibited. Pipetting by mouth is not permitted. All Personal Protective Equipment (PPE) must be removed before leaving the laboratory area and before entering the employee lounge or eating area. Always wash your hands before leaving the laboratory. All relevant Material Safety Data Sheets (MSDSs) are kept in the office area.

5.4 Approved PPE, which includes Safety Glasses, Gloves and Lab Coats, must be worn at ***all*** times when handling samples, reagents, chemicals, or when in the vicinity of others handling these items, so that dermal contact is avoided. All standards, reagents and solvents shall be handled under a hood using the proper PPE. All flammable solvents must be kept in the flammable storage cabinet, and returned to the cabinet immediately after use. When transporting chemicals, use a secure transporting device and/or secondary outer container. Chemical storage is properly segregated and adequately ventilated to reduce the possibility of hazardous reactions. Chemical storage in work areas shall be kept to a minimum. Storage on bench tops or other work surfaces, except temporary, is not permitted.

5.5 All standards and reagents shall be prepared in a hood while using the proper PPE.

5.6 Spilled samples, solvents, reagents, and water must be cleaned up from bench tops, instruments and autosampler surfaces immediately. A spill is considered a quantity of hazardous material if it is two times greater than the normal working volume. Concentrated solvents, acids or bases present a moderate to extreme hazard to the skin and mucous membranes. If contact with the skin occurs, immediately flush with large volumes of water. In the case of acidic/basic spills, the *Spill Kit* located in each laboratory shall be utilized before attempting to cleanup the spill. Although procedures are designed to minimize the possibility of an accident, all injuries or accidents, regardless of the nature or severity, are to be reported to the Section Head Supervisor immediately. If an employee discovers a potentially unsafe condition, this must be reported to the Section Head Supervisor immediately. No employee should feel compelled to work in a situation where they do not feel entirely informed, trained, or safe.

5.7 Analytical instrumentation poses the unique possibility of exposure to high voltages. Other than the *routine* instrument maintenance, as listed in the front of every Instrument Maintenance Logbook, at no time shall an instrument operator attempt to maintenance an instrument alone, or without the proper training, supervision or instruction. Caution must always be used in the presence of moving parts (autosamplers) and hot surfaces (injection ports).

5.8 Compressed gas cylinders shall only be moved with the dolly supplied for this specific purpose. The cap must be on the cylinder while it is being moved. The tank must be secured when in its final position. All spent tanks are to be returned in the same manner, and secured until removed by the vendor. Liquid argon or nitrogen represents a potential cryogenic hazard and safe-handling procedures must be used at all times.

5.9 Caution should be used when handling all aqueous samples, as they are generally preserved to a pH < 2, and pose a potential acid burn hazard.

5.10 All additional company safety practices shall be followed at all times as written in the *Chemical Hygiene Plan*.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

A sample size of 125mL to 500mL sample must be collected in a HDPE container with a Teflon lined screw cap or equivalent. Samples must be acidified to pH <2 with HNO_3, preferably at the time of collection.

6.2 Sample Preservation

Samples must be acidified to pH <2 with HNO_3, preferably at the time of collection.
NOTE: Samples for dissolved metals are filtered prior to acidification.

6.3 Sample Shipping

No special shipping requirements.

6.4 Sample Handling

Preparation of samples must not begin until 18 hours after sample acidification.

If samples are acidified and/or filtered in the laboratory, this must be documented in the *Metals Filtration Logbook*. Samples for dissolved metals are filtered prior to acidification.

Samples and sample filtrates are stored at room temperature or may refrigerated at 4 ± 2°C and analyzed within 6 months.

7. Equipment and Supplies

7.1 Glassware for Digestion: 50mL disposable digestion tubes, watch covers, glass or plastic filter funnels.

7.2 Electric Hot Plate/Block: Adjustable and capable of maintaining a temperature of 90-95°C equipped with graphite carbon blocks that each have 36 positions to hold the sample tubes.

NOTE: Hotplate/Block temperatures are monitored and recorded regularly using NIST calibrated and traceable thermometers. If any thermometer is suspected to not be reading the temperatures correctly, see the QA Department for a certified replacement thermometer.

7.3 Other: Adjustable Eppendorf pipettes and replacement tips, pre-cleaned Filter Mate from Environmental Express (2.0um filter paper and plunger), 10mL glass pipettes, 100mL and 200mL Class-A volumetric flasks.

8. Reagents and Standards

ACS Trace Metal grade chemicals shall be used in all tests. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination. If the purity of a reagent is in question, analyze for contamination. If the concentration is less than the MDL then the reagent is acceptable.

The solutions below expire 6 months from preparation, or expire based on the manufacturer's expiration date, whichever comes first. Standards are stored out of direct light at ambient temperature. Reagents are stored at ambient temperature, under a hood if necessary. Acids are kept in a storage crate under a hood. Once opened, initialed and dated, they are kept in a hood. Acid expiration dates are generally provided by the manufacturer and printed on the label.

8.1 Deionized (DI) water: ASTM Type II laboratory reagent grade water or better (*i.e.*, Type I). The Barnstead NANO-pure system provides Type I water used in the preparation of samples and standards.

8.2 Nitric acid, concentrated (HNO_3): ACS reagent grade, Fisher #A509-212, or equivalent.

8.2.1 Nitric Acid (1:1 HNO_3): Add 500mL concentrated HNO_3 to 400mL DI water and dilute to 1L.

8.3 Spiking solutions:

8.3.1 Laboratory Control Sample (LCS Low) for 3020A/200:2T. The final concentration in the LCS samples are Ag, As, Be, Ca, Cd, Cr, Cu, Co, Fe, Pb, Mg, Mn, Mo, Ni, Sb, Se, Tl, Ti, V, and Zn at 0.04mg/L.

Spike 0.40mL of S3 Solution (Section 8.3.1.1) into the LCS sample.

8.3.1.1 S3 Solution: Adding 5mL of concentrated HNO_3 to a 100mL volumetric flask using a 5mL glass pipette. Then add 2.5mL of IQC-026 Elements Solution (Section 8.3.1.1.1). This solution is brought to 100mL volume with DI water. The final concentration of this solution is 2.5mg/L for Ag, As, Al, B, Ba, Be, Ca, Cd, Cr, Cu, Co, Fe, Pb, Mg, Mn, Mo, Na, Ni, Sb, Se, Tl, Ti, V, and Zn. A final concentration of 1.25mg/L for K and 25mg/L for Si.

8.3.1.1.1 IQC-026 Elements Solution: From ULTRA; contains Ag, Al, As, B, Ba, Be, Ca, Cd, Cr, Cu, Co, Fe, Pb, Mg, Mn, Mo, Na, Ni, Sb, Se, Tl, Ti, V, and Zn at 100mg/L. Si at 50mg/L and K at 1000mg/L.

8.3.2 Laboratory Control Sample (LCS High) for 3020A/200:2T

8.3.2.1 S1 Solution: Prepare by adding 5mL of concentrated HNO3 to a 100mL volumetric flask using a 5mL glass pipette. Then add 10 mL of ICUS-624 (Ultra Scientific) solution containing Be and Cd at 500mg/L, for a concentration of 50mg/L, and Sb, Ba, B, Cr, Cu, Co, Mn, and Mo at 1000mg/L, for a concentration of 100mg/L. Next add 10mL of ICUS-625 (Ultra Scientific) solution containing Zn, Ni, Pb and V at 1000mg/L for a concentration of 100mg/L, and Al, Ca, Fe, Mg, K, and Na at 5000mg/L for a concentration of 500mg/L. Next add 10 mL each of Tl, As and Se (Ultra, Absolute or equivalent) at 1,000mg/L for a concentration of 100mg/L. This solution is brought to volume with DI water.

8.3.2.2 High Spike: Spike 0.25 mL of S1 Solution into the LCS High. See Section 8.3.2.1 for the preparation of the S1 Solution. The final concentrations of metals in the High LCS are: Be and Cd at 0.5mg/L; Ag, Sb, Ba, B, Cr, Cu, Co, Mn, Zn, Ni, Pb, V, Tl, As, Se and Mo at 1mg/L; Al, Ca, Fe, Mg, K and Na at 5mg/L.

8.3.3 Matrix Spiking (MS) solution for 3020A/200:2T:

8.3.3.1 High Spike: Spike 0.25mL of S1 Solution into the MS high sample. See 8.3.2.1 for the preparation of the S1 solution. The final concentration in high MS samples are Be and Cd at 0.5mg/L; Ag, Sb, Ba, B, Cr, Cu, Co, Mn, Zn, Ni, Pb, V, Tl, As, Se and Mo at 1mg/L; and Al, Ca, Fe, Mg, K, and Na at 5mg/L.

8.3.3.2 Low Spike: Spike 0.40mL of S3 into the MS low sample. See Section 8.3.1.1 for preparation of the S3 solution. The final concentration in low MS samples are Ag, As, Be, Ca, Cd, Cr, Cu, Co, Fe, Pb, Mg, Mn, Mo, Ni, Sb, Se, Tl, Ti, V, and Zn at 0.04mg/L.

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blank(s)

A method blank must be prepared in deionized water once per every 20 samples or per digestion batch, whichever is more frequent.

Metals elements of interest must not be detectable in the method blank at a concentration greater than the reporting limit.

Corrective Action: Analysis according to the appropriate analytical SOP may be repeated once to see if an analytical error has occurred. Digestion of the method blank and all associated samples must be performed until the blank is in control. Samples cannot be analyzed until an acceptable method blank analysis is obtained. Exceptions may be made with approval of the Metals Department Manager, Laboratory Director or QAO, if the samples associated with the out of control method blank are non-detect for the elements of interest, or if sample concentrations are greater than 10x the blank levels. In such cases, the sample results are accepted without corrective action for the high method blank and the client is notified in a project narrative associated with the sample results.

9.2 Laboratory Control Sample (LCS)

Laboratory control sample (LCS) must be prepared once per every 20 samples or per digestion batch, whichever is more frequent, in deionized water and spiked with a solution prepared from a second source or lot number, other than the source used to verify the accuracy of the standard curve for the determinative analytical method. The LCS contains all target elements of interest, and is digested along with the samples as verification of the accuracy of the entire digestion procedure. (Refer to Section 8.4.1)

The acceptable recovery QC limits are documented in the applicable analytical SOPs. The aqueous recovery limits are continuously monitored and documented in-house through control charts. The Control Limit Generation SOP (08-07) provides details explaining how control charts are generated and used for quality control.

Corrective Action: Analysis according to the appropriate analytical SOP may be repeated once to see if an analytical error has occurred. If the LCS recovery is still out of control, re-prepare and re-analyze the LCS and all associated samples. Samples cannot be reported until an acceptable LCS is obtained. Exceptions may be made with approval of the Metals Department Manager, Laboratory Director or QAO, if the samples associated with the out of control LCS are also associated with a matrix spike that is in control. This is an acceptable measure of accuracy of the digestion and analytical procedures. An explanation of the out of control LCS recovery must be included in the project narrative to the client and the sample data reported noting the acceptable MS results as batch QC.

9.3 Initial Calibration Verification (ICV)

Not applicable to this method.

9.4 Continuing Calibration Verification (CCV)

Not applicable to this method.

9.5 Matrix Spike

A matrix spike (MS) sample must be performed once per 20 samples (5% frequency), or per digestion batch, whichever is more frequent. The MS contains all target elements of interest. (Refer to Section 8.4.1).

The acceptable % recovery QC limits are documented in the applicable analytical SOPs. The aqueous % recovery QC limits are continuously monitored and documented in-house through control charts which are updated semi-annually. The Control Limit Generation SOP (08-07) provides details explaining how control charts are generated and used for quality control.

Corrective Action: Analysis according to the appropriate analytical SOP may be repeated once to see if an analytical error has occurred. If the % recovery still exceeds the control limits and the LCS is compliant, include a project narrative with the results to client noting that there may be potential matrix effects on the accuracy of the reported results as evidenced by MS recovery outside of QC limits.

9.6 Laboratory Duplicate

Duplicate analyses (matrix or sample duplicate) must be performed once per 20 samples (5% frequency), or per digestion batch, whichever is more frequent.

Acceptable relative percent differences (RPD) of duplicates are documented in the applicable analytical SOPs. Acceptance criterion is not applicable to sample concentrations less than 5 times the reporting limit. Calculate the RPD as follows:

$$RPD = \frac{R1 - R2}{\frac{[R1 + R2]}{2}} \times 100$$

where:
R1 = sample Replicate #1
R2 = sample Replicate #2

The RPD limits are continuously monitored and documented in-house through control charts which are updated semi-annually. The SOP Control Limit Generation (08-07) provides details explaining how control charts are generated and used for quality control.

Corrective Action: Analysis according to the appropriate analytical SOP may be repeated once to see if an analytical error has occurred. If the % RPD still exceeds the control limits, include a project narrative with the results to client noting that there may be potential matrix effects on the precision of the reported metals results as evidenced by the matrix duplicate %RPD exceedance.

9.7 Method-specific Quality Control Samples

None.

9.8 Method Sequence

- Method Blank
- LCS
- Samples 1-20
- Matrix Duplicate
- Matrix Spike

10. Procedure

10.1 Equipment Set-up

Samples are prioritized by the Metals Department Manager or Preparation Group Leader for digestion based on hold time and client due date. Gather all samples for digestion from the Sample Custodian. Batch the samples that are being digested in the LIMS. Include the method blank, LCS, MS and Duplicate samples. If samples appear as if they will need filtration, add a filter blank to the batch as per Section 10.3.2. **Note**: The sample size and proportional volume of reagents used for the digestions have been reduced from the volumes cited in the reference methods.

10.2 Initial Calibration

Not applicable to this method.

10.3 Equipment Operation and Sample Processing

10.3.1 Sample Digestion according to Method 3020A/200:2T

10.3.1.1 Turn on the electric hotplate/hotblock and monitor the temperature to 90-100°C. It takes approximately 120 minutes to reach the proper temperature. Measure 25mL of each sample to the 25mL mark on the disposable digestion tubes. Use 25mL of DI water for the method blank and LCS. Label each tube with the sample batch ID.

10.3.1.2 Add 0.75mL of concentrated nitric acid to each sample. Spike the LCS and MS sample using the solutions prepared in Section 8.4.1, and 8.4.2. All sample spiking must be "spike witnessed".

10.3.1.3 Place the tubes into the block. Cover the samples with a watch cover. Evaporate the samples to approximately 5 – 10 mL, using caution not to let the samples boil, or go to dryness.

10.3.1.4 Remove the samples from the block. When cool, add another 0.75mL of concentrated nitric acid to each sample. Cover the samples with a watch

cover, and place them back into the block. Reflux the samples for 15 minutes, until the digestion is complete (the digestate does not change appearance with continued refluxing). After cooling, bring to 25 mL mark on the digestion tube with DI water.

10.3.2 Sample filtration after digestion:

10.3.2.1 If samples appear to require filtration prior to digestion, a filtration blank may be added to the batch at the beginning of the digestion.

10.3.2.2 The correct initial volume of DI water (25mL for 3020A) and the reagents used in the digestion, are added to a digestion tube, and labeled as the filter blank.

10.3.2.3 After digestion, the filter blank, and any samples that need to be filtered, are filtered through a pre-cleaned filter paper that is part of the Filter Mate and plunger system. The filter is pushed, using the plunger, to the bottom of the original digestion tube, where all of the precipitates are held. Note on the sample preparation batch sheet, which samples were filtered.

10.3.2.4 If after digestion, some samples in the batch need to be filtered, but no filter blank was added to the batch prior to digestion, filter the samples that require filtration and filter the associated method blank and LCS for QC purposes, as in Section 10.3.2.3. Note on the sample preparation batch sheet, which samples were filtered.

10.3.2.5 If a filter blank was prepared at the beginning of the digestion as part of the sample batch, but after digestion, no samples required filtration, the filter blank may be discarded.

10.3.2.6 If, during the filtration steps above, the digestion tube inadvertently cracks, have a clean new tube near by. Quickly transfer the remaining sample digestate (minimum of 5mL) to the new tube. If less than 5mL of digestate remains, the sample must be re-digested. *Under no circumstances should any foreign object be placed into the sample tube to retrieve or re-set the filter plunger, as this may cause sample contamination.*

10.4 Continuing Calibration

Not applicable to this method.

10.5 Preventive Maintenance

The Hot Block thermometers are calibrated on an annual basis by an instrument service company. Certificates are kept on file.

11. Data Evaluation, Calculations and Reporting

Procedures for data and record management for organic extraction must adhere to the Quality Systems Manual, other subordinate documents covering record keeping, and the *Document Control* SOP (G-016). All records must be stored in such a manner as to be safe and accessible for at least 10 years.

See the appropriate analytical SOPs for details on sample analysis, data evaluation, calculations and data reporting.

All results for the metals elements of interests are reportable without qualification if digestion and analytical holding times are met, preservation (including cooler temperatures) are met, all QC criteria defined in the table below are met, and matrix interference is not suspected during digestion or analysis of the samples. If any of the below QC parameters are not met, all associated samples must be evaluated for re-extraction and/or re-analysis.

QC Parameter	Acceptance Criteria
Method Blank	< reporting limit
Laboratory Control Sample	See the applicable analytical SOP for acceptance criteria
Matrix Duplicate	See the applicable analytical SOP for acceptance criteria
Matrix Spike	See the applicable analytical SOP for acceptance criteria
Matrix Spike Duplicate (if needed)	See the applicable analytical SOP for acceptance criteria

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

Section 9 outlines sample batch QC acceptance criteria. If non-compliant inorganic element results are to be reported, the Metals Department Manager, the Laboratory Director, and/or the QAO must approve the reporting of these results. The laboratory Project Manager shall be notified, and may chose to relay the non-compliance to the client, for approval, or other corrective action, such as re-sampling and re-analysis. The instrument analyst or Department Manager performing the secondary analytical review initiates the project narrative, and the narrative must clearly document the non-compliance and provide a reason for acceptance of these results.

13. Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the MDL, LOD, and/or LOQ as outlined in Alpha SOP/08-05. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP/08-12 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

The *Hazardous Waste and Sample Disposal* SOP (G-006), must be referenced for disposal of used standards, solvents, acids, reagents or other chemicals.

Once sample batches have completed digestion, the sample containers are stored in the metals lab and held for 30 days. If there is no sample remaining in the sample collection bottle, it may be rinsed and thrown away. It must be noted in the *Internal COC* that there is no sample remaining in the bottle, and the bottle was discarded.

Once the samples have been held for 30 days, any aqueous sample remaining must be disposed in a 55-gallon drum labeled "Corrosive Liquid".

Once satisfactory inorganic element results have been generated, the digestates are held for 30 days, or longer if specified by a client contract, then discarded into a 55-gallon drum labeled "Corrosive Liquid".

All reagent waste generated during digestion must be stored in satellite containers in the metals preparation laboratory.

Once the reagent waste satellite containers are full, they must be emptied into 55-gallon drums marked "Corrosive Liquid".

Refer to the Chemical Hygiene Plan and the SOP for Hazardous Waste and Disposal (G-006) for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan

SOP/08-05 MDL Generation

SOP/08-12 IDC Generation

SOP/ 01-01 Sample Receipt and Log-In

SOP/08-07 Control Limit Generation

SOP/ 08-01 Document Control

Hazardous Waste and Disposal (G-006)

16. Attachments

None.

ACCUTEST LABORATORIES
STANDARD OPERATING PROCEDURE

Lab Manager:_____

QA Manager:_____

Effective Date: _____

TITLE: pH AND CORROSIVITY FOR SOILS AND SOLID WASTES

METHOD REFERENCE: SW846 9045C and 9045D, SW846 Chapter 7

Revised Sections: Method reference, 4.1, 4.2,

1.0 SCOPE AND APPLICATION

1.1 This method is used to measure the pH and corrosivity of soils and solid wastes. For solid wastes, if an aqueous phase is present, it must be less than 20% of the total volume of the waste. If greater than 20% of the volume is aqueous, then method SW846 9040B should be used.

2.0 SUMMARY

2.1 The sample is mixed with reagent water and then the pH is determined electrometrically using a combination electrode or a separate pH and reference electrode. The pH meter is calibrated before analysis using a series of standard buffer solutions.

3.0 DEFINITIONS

BATCH: A group of samples which behave similarly with respect to the sampling or the testing procedures being employed and which are processed as a unit (see Section 3.4.1 for field samples and Section 4.4.3 for laboratory samples). For QC purposes, if the number of samples in a group is greater than 20, then each group of 20 samples or less will all be handled as a separate batch.

CALIBRATION CHECK STANDARD. The calibration check standard is a mid-range calibration standard. It is recommended that the calibration check standard be run at a frequency of approximately 10 percent. (For some methods this is mandatory and for some it is a recommendation only. Refer to individual method SOP's)

EXTERNAL CHECK STANDARD. The external check standard is a standard from a separate source than the calibration curve that is used to verify the accuracy of the calibration standards. An external check must be run a minimum of once per quarter for all analyses where a check is commercially available. The laboratory should initially assess laboratory performance of a check standard using the control limits generated by the external check supplier. In house limits should also be generated once sufficient external check standard data is available to generate limits

(usually a minimum of 20 to 30 analyses). If the external check is outside of the control limits for a given parameter, all samples must be reanalyzed for that parameter after the problem has been resolved.

SPIKE BLANK OR LAB CONTROL SAMPLE. Digest and analyze a laboratory control sample or spike blank with each set of samples. A minimum of one lab control sample or spike blank is required for every 20 samples. Assess laboratory performance against the control limits specified in the SOP. In house limits should also be generated once sufficient external check standard data is available to generate limits (usually a minimum of 20 to 30 analyses). If the lab control is outside of the control limits for a parameter, all samples must be redigested or redistilled and reanalyzed for that parameter. The exception is if the lab control recovery is high and the results of the samples to be reported are less than the reporting limit. In that case, the sample results can be reported with no flag. Note: If control limits are not specified in the SOP, then default limits of 80 to 120 percent should be used.

MATRIX: The component or substrate (e.g., water, soil) which contains the analyte of interest.

MATRIX DUPLICATE: A duplicate sample is digested at a minimum of 1 in 20 samples. The relative percent difference (RPD) between the duplicate and the sample should be assessed. The duplicate RPD is calculated as shown below. Assess laboratory performance against the control limits that are specified in the SOP. In house limits are generated once sufficient duplicate data is available to generate limits (usually a minimum of 20 to 30 analyses). If a duplicate is out of control, flag the results with the appropriate footnote. If the sample and the duplicate are less than 5 times the reporting limits and are within a range of ± the reporting limit, then the duplicate is considered to be in control. Note: If control limits are not specified in the SOP, use default limits of ± 20% RPD.

$$\frac{(|\text{Sample Result} - \text{Duplicate Result}|) \times 100}{(\text{Sample Result} + \text{Duplicate Result})/2} = \text{Duplicate RPD}$$

METHOD BLANK. The laboratory must digest and analyze a method blank with each set of samples. A minimum of one method blank is required for every 20 samples. For a running batch, a new method blank is required for each different digestion day. If no digestion step is required, then the method blank is equivalent to the reagent blank. The method blank must contain the parameter of interest at levels of less that the reporting limit for that parameter. If the method blank contains levels over the reporting limits, the samples must be redigested or redistilled and reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the method blank level. In addition, if all the samples are less than a client required limit and the method blank is also less than that limit, then the results can be reported as less than that limit.

REAGENT BLANK: The reagent blank is a blank that has the same matrix as the samples, i.e., all added reagents, but did not go through sample preparation procedures. The reagent blank is an indicator for contamination introduced during the analytical procedure. (Note: for methods requiring no preparation step, the reagent blank is equivalent to the method blank.) Either a reagent blank or a method blank must be analyzed with each batch of 20 samples or less. The concentration of the analyte of interest in the reagent blank must be less than the reporting limit

for that analyte. If the reagent blank contains levels over the reporting limits, the samples must be reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the reagent blank level. In addition, if all the samples are less than a client required limit and the reagent blank is also less than that limit, then the results can be reported as less than that limit.

REAGENT GRADE: Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

REAGENT WATER: Water that has been generated by any method which would achieve the performance specifications for ASTM Type II water. For organic analyses, see the definition of organic-free reagent water.

REFERENCE MATERIAL: A material containing known quantities of target analytes in solution or in a homogeneous matrix. It is used to document the bias of the analytical process.

4.0 HEALTH & SAFETY

4.1 The analyst must follow normal safety procedures as outlined in the Accutest Laboratory Safety Manual which includes the use of safety glasses and lab coats. In addition, all acids are corrosive and must be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

4.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical must be treated as a potential health hazard. Exposure to these reagents should be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets must be made available to all personnel involved in these analyses.

5.0 PRESERVATION AND HOLDING TIME

5.1 The sample must be stored at 4^0 C. No preservatives should be added to samples to be analyzed for pH.

5.2 There is no regulatory holding time for soil pH analysis. However, it is recommended that all analyses be done within 28 days of sample collection, at the longest.

6.0 APPARATUS

The items needed for the analysis of pH are listed below.

6.1 pH meter with means for temperature compensation.

6.2 pH and reference electrode. Either a combination electrode or separate electrodes may be used. Normally, a combination electrode is employed.

6.3 Magnetic stir plate and stirring bars.

6.4 Graduated plastic or glass beakers.

6.5 Balance, capable of reading to one place past the decimal. The calibration on the balance must be checked each day before use.

7.0 REAGENTS

7.1 pH buffer solutions at pH 4, 7, and 10. Buffer solutions are commercially available and can be purchased from a number of different vendors.

7.2 pH buffer solutions at pH 2 and 12. These buffers should be used when the samples are < 4 or > 10. These buffer solutions are also commercially available.

8.0 INTERFERENCES

8.1 High levels of sodium can cause interferences when pH levels are > 10. The sodium error can be reduced by using a low-sodium-error electrode. Strong acid solutions, with a true pH of < 1, may give incorrectly high pH measurements.

8.2 Coatings of oily material or particulate matter can impair electrode response. These coatings can usually be removed by gentle wiping or detergent washing. An additional treatment with 1:10 hydrochloric acid may be necessary to remove any remaining film.

8.3 Temperature can also effect the final pH readings. The pH meter should have temperature compensation which account for changes in the electrode output at various temperatures. However, temperature changes can also occur due to changes in the sample as the temperature changes. This error cannot be controlled.

9.0 PROCEDURE

9.1 Below is the procedure to be followed for the analysis of soil and solid waste samples for pH.

9.2 Weigh out 50.0 g of each sample and add 50 mL of deionized water. If the sample is hygroscopic (i.e. absorbs water), then add water until the sample can be stirred and record the total volume of water added.

9.2.1 Smaller weights can be used if necessary, but the larger weight and volume is recommended for better sample reproducibility.

9.3 Stir the sample on a stirring plate continuously for 5 minutes and then let the sample stand until the solids have settled to the bottom of the beaker (approximately 15 minutes to 1 hour). If the solids do not settle out, then the sample may be filtered or centrifuge before analysis. While the samples are settling, the pH meter should be calibrated.

9.3.1 If the supernatant is contains oil and water, then decant off the oily phase and measure the pH of the aqueous phase.

9.4 Calibration of the pH Meter.

9.4.1 Turn on the pH meter and allow it to warm up. Gather all standards and allow them to come to 23 to 27 deg. C. Set the temperature compensation to 25 deg. C.

9.4.1.1 For samples with an alkaline pH of 11 or greater, the temperature of the sample must be within the range of 24 to 26 deg. C.

9.4.2 Following the manufacturers instructions, calibrate the meter using the 2 different buffer solutions that bracket the expected pH of the samples. Normally pH 4 and pH 7 buffer solutions are used.

9.4.3 After the calibration is completed, read back the buffer solutions. Record the results of each analysis on the pH worksheet. If the buffers are not within 0.05 pH units, then recalibrate the meter. If results above 7 or below 4 are expected, then read back the appropriate buffer solutions for the expected range(s).

9.4.4 After the meter is calibrated, analyze the samples by placing the pH electrode in each sample and recording the pH value of the solution. Make sure to rinse the electrode well with DI water between samples. At a minimum, read a bracketing buffer solution after every 10 samples. The results for the buffer should be within 0.2 pH units of the true value

9.4.4.1 If the check is outside of the 0.20 pH unit criteria, check the probe for problems. If the problems are unrelated to the sample matrix, then resolve the problems and reanalyze the samples and the check standards.

9.4.4.2 If the 0.20 pH unit criteria cannot be met due to difficulties with the probe caused by the sample matrix, see the area manager or supervisor. Sample results may be reported with a footnote noting the recovery obtained on the check standard.

9.4.5 Record both the pH value and the temperature for all buffer and sample measurements. Make sure to record the pH to 2 places past the decimal.

9.4.6 If corrosivity is requested, then the sample should be reported as non-corrosive in the range from greater than 2 to less than 12.5. If the pH is less than or equal to 2 or greater than or equal to 12.5, then the sample should be reported as corrosive. Note:

A buffer check at 2 is required for acidic corrosivity checks and a buffer check at 12 is required for basic corrosivity checks if the samples are outside of the range of 4 to 10.

9.4.7 For corrosivity characterization, the sample must be measured at 24 to 26°C if the pH of the sample is above 12.0.

10.0 QUALITY ASSURANCE

10.1 At least 2 pH buffer solutions bracketing the range of the samples and a minimum of approximately 3 pH units apart must be analyzed each time the meter is calibrated, or at a minimum of once per day each day that the meter is used. These buffer solutions should be within 0.05 pH units of the true value.

10.2 A bracketing buffer check should be analyzed, at a minimum, after every 10 samples. This buffer should be within 0.2 pH units of the true value of the solution. Refer to section 9.4.4 for corrective action if the buffer is outside of this range.

10.2.1 A buffer check at 2 is required for acidic corrosivity checks and a buffer check at 12 is required for basic corrosivity checks if the samples are outside of the range of 4 to 10.

10.3 One duplicate should be analyzed for every 20 samples, or one per batch, whichever is more frequent. This quality control point should be evaluated using Accutest's in house quality control limits. If no quality control limits are available, default limits of $\pm$ 5 percent should be applied

11.0 DOCUMENTATION REQUIREMENTS

11.1 All analytical work should be documented on worksheets such as the one attached. All reagent preparation information should be written in the reagent preparation log. Lot numbers of purchased reagents should be recorded on the analytical worksheet. The analyst should sign and date the worksheet.

11.2 All calibration information must also be recorded in the pH calibration logs provided by each pH meter.

11.3 The temperature of the samples and buffers must be recorded for each pH measurement.

11.4 All pH measurements should be recorded to 2 places past the decimal.

12.0 POLLUTION PREVENTION & WASTE MANAGEMENT

12.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment

must be followed. All method users must be familiar with the waste management practices described in section 12.2.

12.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, EHS004. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:

12.2.1 Non hazardous aqueous wastes.

12.2.2 Hazardous aqueous wastes

12.2.3 Chlorinated organic solvents

12.2.4 Non-chlorinated organic solvents

12.2.5 Hazardous solid wastes

12.2.6 Non-hazardous solid wastes

13.0 ADDITIONAL REFERENCES

13.1 Refer to manufacturers manuals for all meters in use.

ACCUTEST LABORATORIES
STANDARD OPERATING PROCEDURE

Lab Manager:_____

QA Manager:_____

Effective Date:_____

TEST NAME: HEXAVALENT CHROMIUM (SOILS)

METHOD REFERENCE: SW846 3060A, Revision 1, Dec. 1996 for digestion
SW846 7196A, Revision 1, July 1992, for analysis.

Revision Sections: 3.1.

1.0 SCOPE AND APPLICATION

1.1 This method is used to determine the concentration of hexavalent chromium in soils, sludges, brick, concrete, and other solid matrices. The solid sample is digested in an alkaline digestion solution to solubilize both water soluble and water insoluble hexavalent chromium compounds. Magnesium chloride in a phosphate buffer is added to suppress oxidation of Cr(III). The hexavalent chromium is determined in the digestate by reaction with diphenylcarbazide in acid solution. The diphenylcarbazide complex produces a characteristic pink color which can be measured spectrophotometrically at 540 nm.

2.0 SUMMARY

2.1 This method uses an alkaline digestion to solubilize both water-insoluble (with the exception of partial solubility of barium chromate in some soil matrices, and water soluble Cr(VI) compounds in solid waste samples. The pH of the digestate must be carefully adjusted during the digestion procedure. Failure to meet the pH specifications will necessitate redigestion of the samples.

2.2 The sample is digested using 0.28M Na2CO3 /0.5M NaOH solution and heating at 90- 95°C for 60 minutes to dissolve the Cr(VI) and stabilize it against reduction to Cr(III).

2.3 The Cr(Vi) reaction with diphenylcarbazide is the most common and reliable method for analysis of Cr(VI) solubilized in the alkaline digestate. The use of diphenylcarbazide has been well established in the colorimetric procedure, in rapid-test field kits, and in the ion chromatographic method for Cr(VI). It is highly selective for Cr(VI) and few interferences are encountered when it is used on alkaline digestates.

3.0 REPORTING LIMIT AND METHOD DETECTION LIMIT

3.1 Reporting Limit. The reporting limit for this method is established at 0.40 mg/kg for soils, based on the low standard of 0.010 mg/l x 100 ml volume volume with a sample weight of 2.5 g.

3.2 Method Detection Limit. Experimentally determine MDLs using the procedure specified in 40 CFR, Part 136, Appendix B. This value represents the lowest reportable concentration of an individual compound that meets the method qualitative identification criteria.

3.2.1 Experimental MDLs must be determined annually for this method.

3.2.2 Process all raw data for the replicate analysis in each MDL study. Forward the processed data to the QA group for archiving.

4.0 DEFINITIONS

BATCH: A group of samples which behave similarly with respect to the sampling or the testing procedures being employed and which are processed as a unit. For QC purposes, if the number of samples in a group is greater than 20, then each group of 20 samples or less will all be handled as a separate batch.

CALIBRATION CHECK STANDARD. The calibration check standard is a mid-range calibration standard. It is recommended that the calibration check standard be run at a frequency of approximately 10 percent. (For some methods this is mandatory and for some it is a recommendation only. Refer to individual method SOP's) For most methods, the mid-level calibration check standard criteria is ± 10 percent of the true value. The exception to this rule is if the recovery on the calibration check standard is high and the samples to be reported are less than the detection limit.

EXTERNAL CHECK STANDARD. The external check standard is a standard from a separate source than the calibration curve that is used to verify the accuracy of the calibration standards. An external check must be run a minimum of once per quarter for all analyses where a check is commercially available. The laboratory should initially assess laboratory performance of a check standard using the control limits generated by the external check supplier. In house limits should also be generated once sufficient external check standard data is available to generate limits (usually a minimum of 20 to 30 analyses). If the external check is outside of the control limits for a given parameter, all samples must be reanalyzed for that parameter after the problem has been resolved.

SPIKE BLANK OR LAB CONTROL SAMPLE. Digest and analyze a laboratory control sample or spike blank with each set of samples. A minimum of one lab control sample or spike blank is required for every 20 samples. Assess laboratory performance against the control limits specified in the SOP. In house limits should also be generated once sufficient external check standard data is available to generate limits (usually a minimum of 20 to 30 analyses). If the lab control is outside of the control limits for a parameter, all samples must be redigested or redistilled and reanalyzed for that parameter. The exception is if the lab control recovery is high and the results of the samples to be reported are less than the reporting limit. In that case, the sample results can be reported with no flag. Note: If control limits are not specified in the SOP, then default limits of 80 to 120 percent should be used.

MATRIX: The component or substrate (e.g., water, soil) which contains the analyte of interest.

MATRIX DUPLICATE: A duplicate sample is digested at a minimum of 1 in 20 samples. The relative percent difference (RPD) between the duplicate and the sample should be assessed. The duplicate RPD is calculated as shown below. Assess laboratory performance against the control limits that are specified in the SOP. In house limits are generated once sufficient duplicate data is available to generate limits (usually a minimum of 20 to 30 analyses). If a duplicate is out of control, flag the results with the appropriate footnote. If the sample and the duplicate are less than 5 times the reporting limits and are within a range of ± the reporting limit, then the duplicate is considered to be in control. Note: If control limits are not specified in the SOP, use default limits of ± 20% RPD.

$$\frac{(|\text{Sample Result} - \text{Duplicate Result}|) \times 100}{(\text{Sample Result} + \text{Duplicate Result})/2} = \text{Duplicate RPD}$$

MATRIX SPIKE: The laboratory must add a known amount of each analyte to a minimum of 1 in 20 samples. The matrix spike recovery is calculated as shown below. Assess laboratory performance against the control limits that are specified in the SOP. In house limits are generated once sufficient matrix spike data is available to generate limits (usually a minimum of 20 to 30 analyses). If a matrix spike is out of control, then the results should be flagged with the appropriate footnote. If the matrix spike amount is less than one fourth of the sample amount, then the sample cannot be assessed against the control limits and should be footnoted to that effect. Note: If control limits are not specified in the SOP, then default limits of 75 to 125 percent should be used.

$$\frac{(\text{Spiked Sample Result} - \text{Sample Result})}{(\text{Amount Spiked})} \times 100 = \text{Matrix Spike Recovery}$$

METHOD BLANK. The laboratory must digest and analyze a method blank with each set of samples. A minimum of one method blank is required for every 20 samples. For a running batch, a new method blank is required for each different digestion day. If no digestion step is required, then the method blank is equivalent to the reagent blank. The method blank must contain the parameter of interest at levels of less that the reporting limit for that parameter. If the method blank contains levels over the reporting limits, the samples must be redigested or redistilled and reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the method blank level. In addition, if all the samples are less than a client required limit and the method blank is also less than that limit, then the results can be reported as less than that limit.

METHOD DETECTION LIMITS (MDLS). The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. MDLs should be determined approximately once per year for frequently analyzed parameters.

REAGENT BLANK: The reagent blank is a blank that has the same matrix as the samples, i.e., all added reagents, but did not go through sample preparation procedures. The reagent blank is an indicator for contamination introduced during the analytical procedure. (Note: for methods requiring no preparation step, the reagent blank is equivalent to the method blank.) Either a reagent blank or a method blank must be analyzed with each batch of 20 samples or less. The concentration of the analyte of interest in the reagent blank must be less than the reporting limit for that analyte. If the reagent blank contains levels over the reporting limits, the samples must be reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the reagent blank level. In addition, if all the samples are less than a client required limit and the reagent blank is also less than that limit, then the results can be reported as less than that limit.

REAGENT GRADE: Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

REAGENT WATER: Water that has been generated by any method which would achieve the performance specifications for ASTM Type II water.

REFERENCE MATERIAL: A material containing known quantities of target analytes in solution or in a homogeneous matrix. It is used to document the bias of the analytical process.

STANDARD CURVE: A plot of concentrations of known analyte standards versus the instrument response to the analyte. Calibration standards are prepared by successively diluting a standard solution to produce working standards which cover the working range of the instrument. Standards should be prepared at the frequency specified in the appropriate section. The calibration standards should be prepared using the same type of acid or solvent and at the same concentration as will result in the samples following sample preparation. This is applicable to organic and inorganic chemical analyses.

5.0 HEALTH & SAFETY

5.1 The analyst must follow normal safety procedures as outlined in the Accutest Laboratory Safety Manual which includes the use of safety glasses and lab coats. In addition, all acids are corrosive and must be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical should be treated as a potential health hazard. Exposure to these reagents must be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets must be made available to all personnel involved in these analyses.

5.3 The following analytes covered by this method have been tentatively classified as known or suspected human or mammalian carcinogens: hexavalent chromium.

6.0 PRESERVATION & HOLDING TIME

6.1 Soil samples should be kept under refrigeration at 4^0 C until time of digestion.

6.2 All samples that are analyzed following this method must be analyzed within 30 days of sample collection. The alkaline digestate is stable for up to 168 hours after extraction from soil.

7.0 INTERFERENCES

7.1 Waste material suspected of containing soluble Cr(III) concentrations greater than 4 times the laboratory Cr(VI) reporting limit may have Cr(VI) results that are biased high due to method induced oxidation. The addition of Mg (II) salts, in a phosphate buffer, is added to suppress this oxidation.

7.2 During the analysis of the alkaline digest for hexavalent chromium using diphenylcarbazide, high concentrations of molybdenum and mercury (> 200 mg/l) can interfere. Concentrations of vanadium greater than 10 times the level of hexavalent chromium may also cause interferences.

8.0 APPARATUS

8.1 Volumetric flasks and pipets and graduated cylinders, class A. All glassware should be washed with soap and tap water and then well rinsed with deionized water.

8.2 50 and 250 ml glass beakers with watch glasses. All glassware should be washed with soap and tap water and then well rinsed with deionized water.

8.3 Filter paper, 0.45 um. Acceptable filter papers include the following: MSI cellulostic white grid filters, 0.45 um, 47 mm (catalog number E04WG047S1).

8.4 Filter pump and vacuum filtration apparatus.

8.5 pH meter.

8.6 Hot plate, capable of maintaining the digestion solutions at 90 to 95 C, with constant stirring ability.

8.7 Four place analytical balance.

8.8 Thermometer, calibrated to an NIST certified thermometer a minimum of once per year.

8.9 Graduated plastic beakers.

8.10 One or two place balance.

8.11 Spectrophotometer capable of measurement at 540 nm, providing a light path of 1 cm or longer. The spectrophotometer should be connected with a strip chart recorder.

9.0 REAGENTS

9.1 All reagents should be made from ACS grade reagents unless otherwise noted. Deionized water should be used whenever water is needed. The expiration date for standards and reagents is the date supplied by the manufacturer or if no expiration date is given, a default of 6 months is used. For acid solutions (nitric, sulfuric, hydrochloric) the expiration date is 2 years from the date of preparation of the solution.

9.2 Nitric acid, HNO_3, concentrated, trace metals grade.

9.3 Nitric acid, HNO_3, 5.0 M, trace metals grade. Add 32 ml of concentrated nitric acid to approximately 50 ml of DI water. Dilute to a final volume of 100 ml with DI water and mix well. Store at 20-25°C in the dark. Do not use concentrated nitric acid to make up the 5.0 M solution if it has a yellow tinge. The yellow color is indicative of a photo reduction of nitrate to nitrite, a reducing agent for Cr(VI).

9.4 Sodium Carbonate, Na_2CO_3, anhydrous.

9.5 Sodium Hydroxide, NaOH.

9.6 Magnesium Chloride, $MgCl_2$ (anhydrous). Note: 392.18 mg of $MgCl_2$ is equivalent to 100 mg of Mg^{2+}.

9.7 Phosphate Buffer Solution (0.5 M K_2HPO_4/0.5 M KH_2PO_4 buffer at pH 7): Dissolve 87.09 g of K_2HPO_4 and 68.04 g of KH_2PO_4 into 700 ml of distilled deionized water. Transfer to a 1 liter volumetric flask and dilute to volume.

9.8 Digestion Solution: Dissolve 20.0 g of NaOH and 30.0 g of Na_2CO_3 in distilled deionized water in a one-liter volumetric flask and dilute to the mark. Store the solution in a tightly capped polyethylene bottle at 20 to 25°C and prepare fresh monthly. The pH of this digestion solution must be checked before using. If the pH is not greater than or equal to 11.5, then the digestion solution should be discarded and a new solution should be made up.

9.9 Insoluble hexavalent chromium spike, lead chromate, $PbCrO_4$. The insoluble matrix spike is prepared by adding 10 to 20 mg of $PbCrO_4$ to the insoluble matrix spike aliquot.

9.10 Soluble hexavalent chromium spiking solution stock. A 1000 mg/l stock solution of potassium dichromate can be used as the stock solution for the spiking solution. (Available as 1000 mg/l chromium solution, AAS grade from Fisher or equivalent).

9.11 Soluble hexavalent chromium spiking solution, 100 mg/l. Add 10.0 ml of the 1000 mg/l hexavalent chromium to a 100 ml volumetric flask and dilute to volume with DI water. Mix well. One (1.00) ml of this spiking solution can be used to spike the soluble matrix spike aliquot. The approximate level of the spike in the spiked sample will be 40 mg/kg.

9.12 Sulfuric acid, 10 percent (v/v). Add 10 ml of concentrated sulfuric acid to approximately 70 ml of DI water. Mix well and let cool. Dilute to a final volume of 100 ml with DI water.

9.13 Acetone. Do not use acetone that comes in a container with a metal or metal lined cap.

9.14 Diphenylcarbazide solution. Dissolve 0.250 g of 1,5 diphenylcarbazide in 50 ml of acetone. Store in a brown or a foil covered bottle to minimize exposure to light. Discard when the solution becomes discolored or monthly, whichever comes first. (Note: Be sure to check the quality of the diphenylcarbazide solution before adding it to the sample.

9.15 Hexavalent Chromium Calibration Standard Solutions. The calibration standards must be

prepared fresh daily or each time the analysis is run. For instrument calibration, prepare the standards from the stocks as shown below. For all standards, add 50 ml of digestion solution to a labeled plastic beaker and then pipet in the appropriate amount of a stock solution. Do not dilute these standards to the final volume at this time. Refer to step 10.8 in the procedure section for further instructions.

9.15.1 Hexavalent Chromium, 10 mg/l stock solution. Add 1.00 ml of 1000 mg/l hexavalent chromium to a 100 ml volumetric flask and dilute to volume with DI water. Mix well.

9.15.2 Hexavalent Chromium, 1.0 mg/l stock solution. Add 10 ml of 10 mg/l hexavalent chromium to a 100 ml volumetric flask and dilute to volume with DI water. Mix well.

9.15.3 Add the amount of stock specified below to the 50 ml of digestion solution.

Blank: No spike is added to the blank.
0.010 mg/l. Add 1.0 ml of 1.00 mg/l
0.050 mg/l: Add 0.50 ml of 10.0 mg/l.
0.100 mg/l: Add 1.00 ml of 10.0 mg/l.
0.300 mg/l: Add 3.00 ml of 10.0 mg/l.
0.500 mg/l: Add 5.00 ml of 10.0 mg/l.
0.800 mg/l: Add 8.00 ml of 10.0 mg/l.
1.00 mg/l: Add 10.0 ml of 10.0 mg/l.

9.16 Hexavalent Chromium CCV (Continuing Calibration Verification) Solutions. The check standards must be prepared fresh daily or each time the analysis is run. Prepare the standards from the stocks as shown below. All check standards must go through the entire digestion process, starting at step 10.3. A minimum of 4 check standards should be made for a batch of 20 samples. Note: The check standards must be made from a different source than the calibration standards.

9.16.1 Hexavalent Chromium 10.0 mg/l stock solution. Add 2.00 ml of 1000 mg/l hexavalent chromium to a 200 ml volumetric flask and dilute to volume with DI water. Mix well.

9.16.2 For initial calibration curves that have the 1.00 mg/l standard as the upper limit, a calibration check at 0.500 mg/l must be used. Therefore, add the amount of stock solution specified below to 50 ml of digestion solution. Do not dilute to a final volume. This entire solution should be digested.

0.500 mg/l: Add 5.00 ml of the 10.0 mg/l stock solution

10.0 DIGESTION PROCEDURE

Below is a step-by-step procedure for the digestion of samples for the determination of hexavalent chromium.

10.1 For each sample to be analyzed, weight out 2.5 ± 0.10 g of the sample into a clean, labeled glass beaker. A one or two place balance may be used for this weighing. The sample should be well mixed before the aliquot is removed as described in OQA-042, the representative sample aliquot SOP.

10.1.1 For the sample that is to be used for the quality control sample, weigh out six 2.5 ± 0.10 g aliquots from the well mixed sample. . One aliquot will be for the soluble Cr(VI) matrix spike, one aliquot will be for the insoluble Cr(VI) matrix spike, one aliquot will be for the original sample analysis, one aliquot will be for the duplicate sample analysis, and the remaining two aliquots will be used to complete the procedures required if the initial post-digest spike does not meet the ± 15 criteria.

10.2 Add the spikes to the matrix spikes and the spike blanks.

10.2.1 Spike the soluble Cr(VI) matrix spike with 1.0 ml of the 100 mg/l Cr(VI) spiking solution. (Check with the area supervisor or manger before starting to see if an additional spike level will be needed.)

10.2.2 Spike the soluble Cr(VI) spike blank with 1.0 ml of the 100 mg/l Cr(VI) spiking solution.

10.2.3 Using an analytical balance, weigh out 0.010 to 0.020 g of $PbCrO_4$ onto a clean piece of weighing paper and carefully add the spike into the insoluble matrix spike sample. Make sure to record the weight used.

10.2.4 Note: This second spike blank is optional. Using an analytical balance, weigh out 0.010 to 0.020 g of $PbCrO_4$ onto a clean piece of weighing paper and carefully add the spike into the insoluble spike blank sample. Make sure to record the weight used.

10.3 Add 50 ml of digestion solution to each sample. Also add 0.392 g of $MgCl_2$ and 0.5 ml of the 1.0 M phosphate buffer. In addition to the samples, 3 extra beakers should be prepared for the method blank, the soluble Cr(VI) spike blank, and the insoluble Cr(VI) spike blank.

10.4 In addition to the samples, the CCV (continuing calibration check) standards should also be digested. Add the entire CCV solution (refer to step 9.16) into a clean, labeled glass beaker. Also add approximately 0.392 g of $MgCl_2$ and 0.5 ml of the 1.0 M phosphate buffer.

10.5 Cover all samples and quality control (including the calibration check samples) with watch glasses. Add a stirring bar to each sample and stir the samples for at least 5 minutes without heating.

10.6 Place the samples on a stirring hot plate that has been preheated to 90 to 95°C. Heat the samples with constant stirring for 60 minutes, maintaining a temperature range of 90 to 95°C. The temperature should be measured by placing a calibrated thermometer in an extra beaker containing digestion reagent on the hot plate. The temperature must be recorded at 30 minutes and 60 minutes during the digestion process. Both the start and the stop time of the digestion must be recorded.

10.7 Cool the samples to room temperature. Filter them through 0.45 um filter paper. Rinse the filter and filtration apparatus with DI water and transfer the filtrate into labeled graduated plastic beakers.

10.7.1 If the filters become clogged using the 0.45 um filter paper, a larger size filter paper (Whatman GFB or GFF) may be used to prefilter the samples. However, the final filtration must be through the 0.45 um filters. If a pre-filtration is required, it should be recorded on the digestion log.

10.7.2 The solids and the filter remaining after the filtration of the matrix spikes may need to be saved in a labeled plastic beaker and stored in the refrigerator. If low recoveries are obtained on the matrix spikes, these solids may be needed for additional analyses. Check with the area supervisor or manager for further instructions.

10.7.3 At this point, the digestates are stable and may be held for up to 168 hours before proceeding with step 10.8.

10.8 Do not start this step unless the analysis will be started within one hour after this step has been completed. The calibration standards should also be taken through this process.

10.8.1 Place a stirring bar in the sample and place it on a stirring plate. Adjust the pH of the solution between 7.00 and 8.00 by carefully adding 5.0 M nitric acid to the digestate

while constantly measuring the pH. Do **not** let the pH of the solution go below 7.00. If the pH goes below 7.00, then the digestate must be discarded and a new digestate prepared. Make sure to record the final pH.

10.8.2 If the pH is changing too rapidly with 5.0 M nitric acid, then a more dilute solution of nitric acid may be used for the pH adjustment.

10.8.3 Carbon dioxide and nitric acid fumes will be evolved during this process. Therefore, this step must be performed in a hood or well ventilated area.

10.9 Quantitatively transfer the contents of the beaker to a 100 ml volumetric flask or class A graduated cylinder and adjust the sample volume to the mark with DI water. Mix well. At this point, a brief description of each sample (color, turbidity, etc.) can be added to the digestion log.

10.9.1 If the same cylinder is used for multiple samples, it must be rinsed with deionized water at least 3 times between samples.

11.0 ANALYSIS PROCEDURE

11.1 Turn on the spectrophotometer and let it warm up for at least 30 minutes. Set the wavelength to 540 nm and adjust the zero.

11.2 Using a class A graduated cylinder, transfer quantitatively 45.0 ml of the sample or standard to be analyzed to a labeled plastic beaker.

11.3 Add 1.0 ml of diphenylcarbazide solution and mix well.

11.4 Slowly add 10 percent sulfuric acid to each sample, mixing well after each addition. Adjust the pH to a range of 1.5 to 2.5. Test the pH of each sample with a pH meter when the effervescence is minimal and record this reading. (On some samples, a small amount of effervescence has been observed several hours after the pH adjustment was completed.)

11.4.1 A background correction point must also be prepared for each sample with 10 ml of sample adjusted to a pH of 1.5 to 2.5 with sulfuric acid. The background correction point should not contain diphenylcarbazide. Make sure to record the adjusted pH of the background correction point.

11.5 If the samples are turbid at this point, filter them through a 0.45 um filter. If the sample aliquot is filtered, the background aliquot must also be filtered.

11.6 Transfer the samples to 50 ml volumetric flasks or class A graduated cylinders and dilute to a final volume of 50 ml with DI water. Let the samples stand for 5 to 10 minutes after the reagents are added for full color development.

11.6.1 If the same cylinder is used for multiple samples, it must be rinsed with deionized water at least 3 times between samples.

11.7 Read the standard calibration curve first, and then a calibration check standard and a reagent blank, making sure to record all results on the strip chart recorder. The correlation coefficient for the curve must be greater than or equal to 0.995, the check standard must be within 10 percent

of the true value, and the reagent blank must be less than the reporting detection limit before the analysis can be continued.

$$r = \frac{\Sigma(x - \bar{x})(y - \bar{y})}{\sqrt{\Sigma(x - \bar{x})^2 \Sigma(y - \bar{y})^2}}$$

Where r = correlation coefficient
x = amount of analyte
y = response of instrument

$\bar{x}$ = average of x values

$\bar{y}$ = average of y values

11.8 After the curve and the initial quality control are completed, the samples may be analyzed. First read the sample result. If the result is over the highest point in the calibration curve, do not read the background correction point. If the result is within the calibration curve, the background correction point must be read immediately after the sample analysis is complete and before starting the next sample.

11.9 After every 10 samples or every 20 readings (10 samples plus 10 background correction points), a digested CCV and a reagent blank will be analyzed. The reagent blank must be less than the reporting limit, and the CCV must be within 10% of the true value. If they are outside of this range, do not proceed. Check with the laboratory supervisor or manager for further directions.

11.10 After the quality control sample analysis is completed, prepare a post-digest spike on this sample. The sample should be spiked at 2 times the concentration found in the original sample aliquot or 40 mg Cr(VI)/kg, whichever is greater. Then proceed through steps 11.3 to 11.6 and analyze the spiked sample. Calculate the recovery immediately. If the recovery is not within 85 to 115 percent, proceed to steps 11.11 and 11.12.

11.10.1 The 40 mg/kg spike can be made by spiking a 45 ml aliquot of digestate containing 1.125 g of digested sample with 0.45 ml of 100 mg/l Cr(VI) standard (Section 9.10).

11.10.2 This spiking level requirement is taken from method 3060a. A lower level spiking requirement is given in the NJDEP 7196A method, but guidance from the state suggested using the 3060A spiking levels when following the 3060a digestion.

11.11 Dilute by a factor of 1:5 a fraction of the quality control sample. Place 45 ml of the diluted sample into a plastic beaker. Then proceed through steps 11.3 to 11.6 and analyze the sample. Also prepare a background correction point at this dilution and analyze it immediately following the analysis of the diluted sample.

11.12 Take an additional 45 ml aliquot of the sample and adjust the pH to between 8.0 and 8.5 using 1.0 N NaOH. Record the final pH. Then spike the sample at 2 times the concentration found in

the original sample aliquot or 40 mg Cr(VI)/kg, whichever is greater. After the sample is spiked, proceed with steps 11.3 through 11.6, and analyze the pH adjusted post-digest spike.

11.13 The calculations should be done as shown below. Values less than the IDL should be treated as zero for all calculations.

11.13.1 Calculation of the sample result.

Conc. Cr(VI) in the sample in mg/kg =

$$\frac{\text{(conc. in digestate in ug/ml) x (final volume in ml) x DF}}{\text{(initial sample weight in g) x (\%solids/100}}$$

11.13.2 Calculation of amount spiked.

Spike amount (SA) in mg/kg =

$$\frac{\text{(conc. of spiking solution, ug/ml) x (vol. of spike, ml)}}{\text{(initial sample weight in g) x (\%solids/100)}}$$

11.13.3 Calculation of matrix spike recovery.

$$\text{MS Rec.} = \frac{\text{(SSR - SR) x 100}}{\text{SA}}$$

where SSR = Spiked sample result
SR = Sample result and
SA = Spike added.

11.13.4 Calculation of duplicate rpd.

$$\text{Dup RPD.} = \frac{\text{(SR - DR) x 100}}{\text{\{(SR + DR)/2\}}}$$

where SR = Sample result and
DR = Duplicate result.

12.0 QUALITY CONTROL

This section outlines the minimum QA/QC operations necessary to satisfy the analytical requirements as taken from these methods. Make sure to check with the laboratory supervisor or manager for any additional client specific quality control requirements.

12.1 A new 5 point calibration curve must be analyzed on each analysis day. The calibration curve must have a correlation coefficient greater than or equal to 0.995 percent.

12.2 All samples should initially be analyzed undiluted. If the sample concentration is higher than the highest standard, then the sample should be diluted and reanalyzed. The dilution should be made so that, if possible, the sample is in the mid-range of the calibration curve.

12.3 One preparation blank is required for each set of 20 samples or less or with each batch, whichever is most frequent. The preparation blank must contain all of the reagents in the sample volumes as used in the preparation of the samples. (The preparation blank should never be used to blank correct the samples.) The preparation blank must be less than the reporting limit. If the preparation blank does not meet the criteria, then the entire batch must be redigested.

12.4 A continuing calibration verification (CCV) standard at approximately the mid-point of the curve must be analyzed after every 10 samples or every 20 readings (10 sample readings plus 10 background readings). The CCV standard must be prepared from a different stock than the calibration curve and should be taken through the digestion process as outlined in the procedure section of this SOP. A CCV standard must be analyzed at the beginning of the analysis immediately after the analysis of the calibration curve. All CCV standards must be within 10 percent of the true value for that standard. If they are outside of this range, do not proceed. Check with the laboratory supervisor or manager for further directions.

12.5 A reagent blank (or CCB) must be analyzed after each CCV. The reagent blank must be less than the reporting detection limit. If this criteria is not met do not proceed. Check with the laboratory supervisor or manager for further directions.

12.6 A duplicate sample must be prepared and analyzed for each set of 20 samples of a similar matrix or with each batch, whichever is smaller. An acceptance criteria of 20 percent relative percent difference should be applied if the original and duplicate sample values are greater than or equal to 4 times the reporting detection limit. If the values are less than 4 times the reporting detection limit, then a control limit of ± the reporting detection limit should be applied.

12.7 Both a soluble and an insoluble hexavalent chromium matrix spike must be prepared and analyzed for each set of 20 samples of a similar matrix or with each batch, whichever is smaller. The acceptance range for matrix spike recoveries is 75 to 125 percent recovery. If the matrix spike recoveries for either the soluble or the insoluble spikes are not within these recovery limits, then the lab supervisor or manager must be immediately notified. The client services deparment will then be notified to contact the client. The method requires additional testing as listed below, but the lab should not proceed with this testing until client approval is obtained and the testing is logged into the LIMS system.

12.7.1 All samples and quality control must be rehomogenized, redigested and reanalyzed to verify the original sample results.

12.7.2 Additional tests, such as oxidation-reduction potential, pH, sulfide, ferrous iron, etc., may be requested to help quantify the reducing nature of the sample. For some projects, eH and pH analysis may be specified for all samples at the start of the project. Eh and pH data plots must be provided in the data deliverable if this analysis is specified

12.7.3 A mass balance study for total chromium may be done, using the digested solids remaining after the alkaline digestion and filtration of the matrix spike and from a unspiked aliquot of the sample.

12.8 A post-digest spike must be prepared and analyzed for each set of 20 samples of a similar matrix or with each batch, whichever is smaller. The acceptance range for post digest spike recoveries is 85 to 115 percent recovery.

12.9 A spike blank or lab control sample must be prepared and analyzed for each set of 20 samples of a similar matrix or with each batch, whichever is smaller The spike blank or lab control can be prepared using either soluble or insoluble hexavalent chromium as the spike. The acceptance range for the spike blanks is 80 to 120 percent recovery. If the spike blanks are not within that range, then the entire batch must be redigested and reanalyzed.

13.0 DOCUMENTATION REQUIREMENTS

13.1 The analyst should document all relevant information, including all sample weights and volumes, digestion times and temperatures, all intermediate and final pH values, all times relevant to the pH adjustment process, all sample and background analysis results, and any relevant comments for any section of the digestion or analysis. Sample digestion and analysis sheets are provided.

13.2 Analyses are done using an automated analysis spreadsheet where the sample absorbances are recorded electronically. If this electronic recording option is not available, then the analyst must verify all recorded absorbances. All reagent identification numbers should be recorded on the sample worksheets. In addition, all reagent information such as lot numbers should also be recorded in the reagent logbook.

14.0 DATA REVIEW AND REPORTING

14.1 All samples should be updated to analysis (GN) batches in the LIMS system. The analyst should calculate all matrix spike, duplicate, external, and CCV recoveries and review the results of all blanks.

14.2 All documentation must be completed, including reagent references and spike amounts and spiking solution references.

14.3 A data file should be exported to the LIMS system and the spike amounts should be entered into the file at the GNAPP process step.

14.4 A final data package, consisting of the prep and analysis raw data, the LIMS cover page, the reagent reference pages, and the QC summary pages must be turned into the area supervisor or other senior reviewer for review.

14.5 After review by the supervisor, the data is released in the LIMS for access to the clients.

15.0 POLLUTION PREVENTION & WASTE MANAGEMENT

15.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 15.2.

15.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, EHS004. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:

15.2.1 Non hazardous aqueous wastes

15.2.2 Hazardous aqueous wastes

15.2.3 Chlorinated organic solvents

15.2.4 Non-chlorinated organic solvents

15.2.5 Hazardous solid wastes

15.2.6 Non-hazardous solid wastes

16.0 ADDITIONAL REFERENCES

16.1 No additional references are required for this SOP.

ACCUTEST LABORATORIES
STANDARD OPERATING PROCEDURE

Lab Manager: Nancy Cole

QA Manager: Mary Gorbunov
for Phil Worby

Effective Date: 6/3/11

TEST NAME: HEXAVALENT CHROMIUM IN WATERS

METHOD REFERENCE: SW846 Method 7196a

Revised Sections: ***3.2.2, 10.6.1***

1.0 SCOPE AND APPLICATION

1.1 This method is used to determine the concentration of hexavalent chromium in aqueous matrices. The hexavalent chromium is determined in the sample by reaction with diphenylcarbazide in acid solution. The diphenylcarbazide complex produces a characteristic pink color that can be measured spectrophotometrically at 540 nm.

2.0 SUMMARY

2.1 Dissolved hexavalent chromium, in the absence of interfering amounts of substances such as molybdenum, vanadium, and mercury, may be determined colorimetrically by reaction with diphenylcarbazide in acid solution. A red-violet color of unknown composition is produced. The reaction is very sensitive, the absorbancy index per gram atom of chromium being about 40,000 at 540 nm. Addition of an excess of diphenylcarbazide yields the red-violet product, and its absorbance is measured photometrically at 540 nm.

3.0 REPORTING LIMIT AND METHOD DETECTION LIMIT

3.1 Reporting Limit. The reporting limit for this method is established at 0.010 mg/l.

3.2 Method Detection Limit. Experimentally determine MDLs using the procedure specified in 40 CFR, Part 136, Appendix B. This value represents the lowest reportable concentration of an individual compound that meets the method qualitative identification criteria.

3.2.1 Experimental MDLs must be determined annually for this method.

3.2.2 Process all raw data for the replicate analysis in each MDL study

4.0 DEFINITIONS

BATCH: A group of samples which behave similarly with respect to the sampling or the testing procedures being employed and which are processed as a unit. For QC purposes, if the number of samples in a group is greater than 20, then each group of 20 samples or less will all be handled as a separate batch.

CALIBRATION CHECK STANDARD. The calibration check standard is a mid-range calibration standard. It is recommended that the calibration check standard be run at a frequency of approximately 10 percent. (For some methods this is mandatory and for some it is a recommendation only. Refer to individual method SOP's) For most methods, the mid-level calibration check standard criteria is ± 10 percent of the

true value. The exception to this rule is if the recovery on the calibration check standard is high and the samples to be reported are less than the detection limit.

EXTERNAL CHECK STANDARD. The external check standard is a standard from a separate source than the calibration curve that is used to verify the accuracy of the calibration standards. An external check must be run a minimum of once per quarter for all analyses where a check is commercially available. The laboratory should initially assess laboratory performance of a check standard using the control limits generated by the external check supplier. In house limits should also be generated once sufficient external check standard data is available to generate limits (usually a minimum of 20 to 30 analyses). If the external check is outside of the control limits for a given parameter, all samples must be reanalyzed for that parameter after the problem has been resolved.

SPIKE BLANK OR LAB CONTROL SAMPLE. Digest and analyze a laboratory control sample or spike blank with each set of samples. A minimum of one lab control sample or spike blank is required for every 20 samples. Assess laboratory performance against the control limits specified in the SOP. In house limits should also be generated once sufficient external check standard data is available to generate limits (usually a minimum of 20 to 30 analyses). If the lab control is outside of the control limits for a parameter, all samples must be redigested or redistilled and reanalyzed for that parameter. The exception is if the lab control recovery is high and the results of the samples to be reported are less than the reporting limit. In that case, the sample results can be reported with no flag. Note: If control limits are not specified in the SOP, then default limits of 80 to 120 percent should be used.

MATRIX: The component or substrate (e.g., water, soil) which contains the analyte of interest.

MATRIX DUPLICATE: A duplicate sample is digested at a minimum of 1 in 20 samples. The relative percent difference (RPD) between the duplicate and the sample should be assessed. The duplicate RPD is calculated as shown below. Assess laboratory performance against the control limits that are specified in the SOP. In house limits are generated once sufficient duplicate data is available to generate limits (usually a minimum of 20 to 30 analyses). If a duplicate is out of control, flag the results with the appropriate footnote. If the sample and the duplicate are less than 5 times the reporting limits and are within a range of ± the reporting limit, then the duplicate is considered to be in control. Note: If control limits are not specified in the SOP, use default limits of ± 20% RPD.

$$\frac{(|\text{Sample Result} - \text{Duplicate Result}|) \times 100}{(\text{Sample Result} + \text{Duplicate Result})/2} = \text{Duplicate RPD}$$

MATRIX SPIKE: The laboratory must add a known amount of each analyte to a minimum of 1 in 20 samples. The matrix spike recovery is calculated as shown below. Assess laboratory performance against the control limits that are specified in the SOP. In house limits are generated once sufficient matrix spike data is available to generate limits (usually a minimum of 20 to 30 analyses). If a matrix spike is out of control, then the results should be flagged with the appropriate footnote. If the matrix spike amount is less than one fourth of the sample amount, then the sample cannot be assessed against the control limits and should be footnoted to that effect. Note: If control limits are not specified in the SOP, then default limits of 75 to 125 percent should be used.

$$\frac{(\text{Spiked Sample Result} - \text{Sample Result})}{(\text{Amount Spiked})} \times 100 = \text{Matrix Spike Recovery}$$

METHOD BLANK. The laboratory must digest and analyze a method blank with each set of samples. A minimum of one method blank is required for every 20 samples. For a running batch, a new method blank is required for each different digestion day. If no digestion step is required, then the method blank is

equivalent to the reagent blank. The method blank must contain the parameter of interest at levels of less that the reporting limit for that parameter. If the method blank contains levels over the reporting limits, the samples must be redigested or redistilled and reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the method blank level. In addition, if all the samples are less than a client required limit and the method blank is also less than that limit, then the results can be reported as less than that limit.

METHOD DETECTION LIMITS (MDLS The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. MDLs are determined approximately once per year for frequently analyzed parameters.

REAGENT BLANK: The reagent blank is a blank that has the same matrix as the samples, i.e., all added reagents, but did not go through sample preparation procedures. The reagent blank is an indicator for contamination introduced during the analytical procedure. (Note: for methods requiring no preparation step, the reagent blank is equivalent to the method blank.) Either a reagent blank or a method blank must be analyzed with each batch of 20 samples or less. The concentration of the analyte of interest in the reagent blank must be less than the reporting limit for that analyte. If the reagent blank contains levels over the reporting limits, the samples must be reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the reagent blank level. In addition, if all the samples are less than a client required limit and the reagent blank is also less than that limit, then the results can be reported as less than that limit.

REAGENT GRADE: Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

REAGENT WATER: Water that has been generated by any method which would achieve the performance specifications for ASTM Type II water. For organic analyses, see the definition of organic-free reagent water.

REFERENCE MATERIAL: A material containing known quantities of target analytes in solution or in a homogeneous matrix. It is used to document the bias of the analytical process.

STANDARD CURVE: A plot of concentrations of known analyte standards versus the instrument response to the analyte. Calibration standards are prepared by successively diluting a standard solution to produce working standards which cover the working range of the instrument. Standards should be prepared at the frequency specified in the appropriate section. The calibration standards should be prepared using the same type of acid or solvent and at the same concentration as will result in the samples following sample preparation. This is applicable to organic and inorganic chemical analyses.

5.0 HEALTH & SAFETY

5.1 The analyst must follow normal safety procedures as outlined in the Accutest Laboratory Safety Manual which includes the use of safety glasses and lab coats. In addition, all acids are corrosive and must be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor.

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical must be treated as a potential health hazard. Exposure to these reagents must be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets must be made available to all personnel involved in these analyses.

5.3 The following analytes covered by this method have been tentatively classified as known or suspected, human or mammalian carcinogens: hexavalent chromium.

6.0 PRESERVATION & HOLDING TIME

6.1 Refrigerate all samples at 4°C until the time of analysis.

6.2 The holding time for this method is 24 hours from the time of collection. Analyze all samples within 24 hours.

7.0 INTERFERENCES

7.1 The hexavalent chromium reaction with diphenylcarbazide is usually free from interferences. However, certain substances may interfere if the hexavalent chromium concentration is relatively low. Hexavalent molybdenum and mercury salts also react to form color with the reagent: however, the red-violet intensities produced are much lower than those for chromium at the specified pH. Concentrations of up to 200 mg/L of molybdenum and mercury can generally be tolerated. Vanadium interferes strongly, but concentrations up to 10 times that of hexavalent chromium will not generally cause interference.

7.2 Iron in concentrations greater than 1 mg/L may produce a yellow color, but the ferric iron color is not strong and difficulty is not normally encountered if the absorbance is measured photometrically at the appropriate wavelength.

7.3 Reducing substances such as organic matter or sulfides can convert hexavalent chromium to trivalent chromium. These reactions may occur in the natural environment and during the digestion and measurement processes.

8.0 APPARATUS

8.1 Spectrophotometer capable of measurement at 540 nm, providing a light path of 1 cm or longer.

8.2 50 ml graduated cylinder (class A) with a stopper.

8.3 Volumetric flasks, class A.

8.4 Volumetric pipets, class A, for standards preparation.

8.5 Filter paper, 0.45 um and 0.10 um. Acceptable filter papers include the following:

8.5.1 MSI cellulostic white grid filters, 0.45 um, 47 mm (catalog number E04WG047S1)

8.5.2 Porectics polycarbonate membrane filters, 0.10 um, 47 mm (catalog number 13010)

8.6 Filter pump and vacuum filtration apparatus.

8.7 pH meter. Orion pH/ISE Meter Model 710A or equivalent

8.8 Four-place analytical balance. Acculab LA-110 or equivalent.

8.9 Graduated Plastic Beakers.

8.10 One or two place balance. Ohaus Galaxy 4000 or equivalent.

9.0 REAGENTS

9.1 All chemicals listed below are reagent grade unless otherwise specified. Use deionized water whenever water is required. The expiration date for standards and reagents is the date supplied by the manufacturer or if no expiration date is given, a default of 6 months is used. For acid solutions (nitric, sulfuric, hydrochloric) the expiration date is 2 years from the date of preparation of the solution.

9.2 Sulfuric acid, 10 percent (v/v): Add 10 ml of concentrated sulfuric acid to approximately 70 ml of DI water. Mix well and let cool. Dilute to a final volume of 100 ml with DI water.

9.3 Diphenylcarbazide Solution: Dissolve 250 mg of 1,5 diphenylcarbazide in 50 ml of acetone. Mix well. Store in a brown bottle or in a foil wrapped container to protect the solution from the light. Discard when the solution becomes discolored or monthly, whichever comes first. (NOTE: Make sure to check the quality of the diphenylcarbazide solution before adding it to the samples.)

9.4 Acetone. Do not use acetone that comes in container with metal or metal-lined caps.

9.5 Hexavalent Chromium Stock Solution. A 1000 mg/L (as Cr(VI))stock solution of potassium dichromate can be used as the stock solution for the spiking solutions and calibration standards. (Available as 1000 mg/L chromium solution, AAS grade from Fisher.)

9.6 Hexavalent Chromium Calibration Standard Solutions: Prepare the calibration standards fresh daily or each time the analysis is run. For instrument calibration, prepare the standards from the stocks as shown below.

9.6.1 Hexavalent Chromium 5.00 mg/L stock solution. Add 1.00 ml of 1000 mg/L hexavalent chromium to a 200 ml volumetric flask and dilute to volume with DI water. Mix well.

9.6.2 Hexavalent Chromium 1.00 mg/L stock solution. Add 10.00 ml of 5.0 mg/L hexavalent chromium to a 50 ml volumetric flask and dilute to volume with DI water. Mix well.

9.6.3 Hexavalent Chromium 7.5 mg/L stock solution. Dilute 1.50 ml of the 1000 mg/L stock solution to a final volume of 200 ml with DI water and mix well. (For use for spiking.)

9.6.4 Add the amount of stock specified below to the 50 ml volumetrics and bring to a final volume of 50 ml with DI water.

Blank: No spike is added to the blank.
0.010 mg/l: Add 0.50 ml of 1.00 mg/L.
0.050 mg/L: Add 0.50 ml of 5.00 mg/L.
0.100 mg/L: Add 1.00 ml of 5.00 mg/L.
0.300 mg/L: Add 3.00 ml of 5.00 mg/L.
0.500 mg/L: Add 5.00 ml of 5.00 mg/L.
0.800 mg/L: Add 8.00 ml of 5.00 mg/L.
1.00 mg/L: Add 10.0 ml of 5.00 mg/L.
2.00 mg/L: Add 20.0 ml of 5.00 mg/L. (*)

(*) If the curve is more linear without the 2.00 mg/l standard, then do not use this standard.

9.7 Hexavalent Chromium Check Standard Solutions: Prepare the check standards fresh daily or each time the analysis is run. Prepare the standards from the stocks as shown below. NOTE: Prepare the check standards from a different source than the calibration standards.

9.7.1 Hexavalent Chromium 5.0 mg/L stock solution. Add 1.00 ml of 1000 mg/L hexavalent chromium to a 200 ml volumetric flask and dilute to volume with DI water. Mix well.

9.7.2 Add the amount of stock specified below to DI water and dilute to a final volume of 50 ml.

9.7.2.1 For initial calibration curves that have the 2.00 mg/L standard as the upper limit, a calibration check at 1.00 mg/L is used. Therefore, add the amount of stock solution specified below to DI water and dilute to a final volume of 50 ml:

1.00 mg/L: Add 10.00 ml of the 5.00 mg/L stock solution .

9.7.1.1 For initial calibration curves that have the 1.00 mg/L standard as the upper limit, a calibration check at 0.500 mg/L is used. Therefore, add the amount of stock solution specified below to DI water and dilute to a final volume of 50 ml.

0.500 mg/L: Add 5.00 ml of the 5.00 mg/L stock solution.

9.8 1.0 N Sodium Hydroxide, NaOH. Add 4.0 g of NaOH pellets to Di water and dilute to a final volume of 100 ml. Mix well.

10.0 ANALYSIS

10.1 Turn on the spectrophotometer and let it warm up for at least 30 minutes. Set the wavelength to 540 nm and adjust the zero.

10.2 Using a graduated cylinder, transfer quantitatively 45.0 ml of the sample or standard to be analyzed to a labeled plastic beaker.

10.3 Add 1.0 ml of diphenylcarbazide solution and mix well.

10.4 Slowly add 10 percent sulfuric acid to each sample, mixing well after each addition. Adjust the pH to a range of 1.5 to 2.5. Test the pH of each sample with a pH meter when the effervescence is minimal and record this reading. (No significant effervescence is expected for most aqueous samples, although this will be seen when analyzing soil digestates.)

10.5 If the samples are turbid at this point, filter them through a 0.45 um filter. If they are still turbid after this filtration, a 0.10 um filter may also be used.

10.6 Transfer the samples to 50 ml volumetric flasks or class A graduated cylinders and dilute to a final volume of 50 ml with DI water. Let the samples stand for 5 to 10 minutes after the reagents are added for full color development. If the sample volume is greater than 50 ml, make sure to correct for the volume difference in the calculations.

10.6.1 Make sure to look at the initial color development of the samples. If the sample initially forms a dark color which quickly starts to fade, this indicates that the sample contains a high level of hexavalent chromium and should be run on dilution.

10.6.2 If the same cylinder is used for multiple samples, it must be rinsed with deionized water at least 3 times between samples.

10.7 Read the standard curve first and then a calibration check standard and a reagent blank, making sure to record all results on the strip chart recorder. The curve correlation coefficient is required to be greater than or equal to 0.995 and the check standard is required to be within 10 percent of the true value before the analysis can be continued.

10.8 After the curve and initial quality control is completed, the samples may be analyzed. First read the sample result. If it is over the calibration curve, do not read a background correction point. If it is within the calibration curve, a background correction point is prepared with 10 ml of sample adjusted to a pH of 1.5 to 2.5 with sulfuric acid. Make sure to record the adjusted pH of the background correction point. Do not add diphenylcarbazide reagent to the background correction point. Note: If the sample was filtered, process the background correction sample through the same filtration procedure. Read the background correction point immediately after the sample analysis is completed.

10.9 After every 10 samples, every 20 readings (10 samples plus 10 background correction points) and at the end of the sample analysis sequence a digested calibration check and a reagent blank should be analyzed.

10.10 Prepare a Method blank per batch of 20 or less. The method blank consists of 50 ml of deionized water.

10.11 Prepare a spike blank per batch of 20 or less. Spike the blank with150ug Cr(VI)/L, (The 150 ug/L spike can be made by spiking 1.0 ml of 7.5 mg/L Cr(VI) standard to a final volume of 50 ml.) Then proceed through steps 10.3 through 10.6 and analyze the sample.

10.12 Prepare a matrix spike and a duplicate on at least one sample per batch of 20 or less. Spike the sample selected as the matrix spike sample at 2 times the concentration found in the original sample aliquot or 150ug Cr(VI)/L, whichever is greater. (The 150 ug/L spike can be made by spiking 1.0 ml of 7.5 mg/L Cr(VI) standard to a final volume of 50 ml.) Then proceed through steps 10.3

through 10.6 and analyze the sample. Calculate the recovery immediately. If the recovery is not within 85 to 115 percent, proceed to steps 10.13 and 10.14.

10.13 Dilute a fraction of the quality control sample 1:5 and place 45 ml of the sample into a plastic beaker. Then proceed through steps 10.3 through 10.6 and analyze the sample. Also prepare a background correction point at this dilution and analyze it.

10.14 Take an additional 45 ml aliquot of the sample and adjust the pH to between 8.0 to 8.5 using 1.0 N NaOH. Record the final pH. Then spike the sample at 2 times the concentration found in the original sample aliquot or 150 ug Cr(VI)/L, whichever is greater. After the sample is spiked, proceed with steps 10.3 through 10.6. If the sample volume is greater than 50 ml, make sure to correct for the volume difference in the calculations.

11.0 CALCULATIONS

11.1 Calculation of the sample result.

conc. of hexavalent chromium in the sample (mg/l)=

$$\frac{\text{(conc. in ext.(mg/l) x (final ext. vol.(ml)}}{\text{(initial sample vol. (ml))}}$$

11.2 Calculation of amount spiked.

Amount spiked of hexavalent chromium (SA)=

$$\frac{\text{(conc. of spiking solution (ug/ml)) x (vol. of spike (ml)}}{\text{(sample volume in ml)}}$$

11.3 Calculation of Matrix Spike Recovery.

$$\text{Percent recovery} = \frac{(SSR - SR) \times 100}{SA}$$

where SSR = Spiked sample result
SR = Sample result
SA = Spike added

11.4 Calculation of Calibration Check Standard (CCS) recovery.

$$\text{Percent recovery} = \frac{\text{CCS result} \times 100}{\text{True Value}}$$

11.5 Calculation of Relative Percent Difference (RPD).

$$RPD = \frac{2(|\text{Sample result} - \text{Duplicate result}|) \times 100}{(\text{Sample result} + \text{Duplicate result})}$$

12.0 QC REQUIREMENTS

12.1 Analyze a new 5 point calibration curve, at a minimum, on each analysis day. Up to eight calibration standards may be employed. The calibration curve is required to have a correlation coefficient greater than or equal to 0.995 percent. (Note: The 2.0 mg/L standard may be dropped from the curve to increase linearity.)

$$r = \frac{\Sigma(x - \bar{x})(y - \bar{y})}{\sqrt{\Sigma(x - \bar{x})^2 \Sigma(y - \bar{y})^2}}$$

Where r = correlation coefficient
x = amount of analyte
y = response of instrument

$\bar{x}$ = average of x values

$\bar{y}$ = average of y values

12.2 Initially analyze all samples undiluted. If the sample concentration is higher than the highest standard, then reanalyze the sample as a dilution. Prepare the dilution so that the sample is in the mid-range of the calibration curve.

12.3 One preparation blank is required for each set of 20 samples or less or with each batch. The preparation blank is required to contain all the reagents in the same volumes as used in the preparation of the samples. The preparation blank is required to be less than the RL. If it exceeds this limit do not proceed. Check with the laboratory supervisor or manager for further directions.

12.4 After every 10 samples, every 20 readings (10 samples plus 10 background correction points) and at the end of the sample analysis sequence a digested calibration check and a reagent blank must be analyzed. Prepare the mid-point calibration check from a different stock than the calibration curve. This calibration check standard must also be analyzed at the beginning of the analysis immediately after the calibration curve. The acceptance criteria for the mid-range calibration check standard is 90 – 110% of the true value of the standard. If they are outside of this range, do not proceed. Check with the laboratory supervisor of manager for further directions.

12.5 Analyze a reagent blank after each mid-calibration check standard. The reagent blank is required to be less than the RL. If it exceeds this limit do not proceed. Check with the laboratory supervisor or manager for further directions.

12.6 Prepare and analyze a duplicate sample for each set of 20 samples of a similar matrix or with each batch, whichever is smaller. An acceptance criteria of 20 percent relative percent difference is applied if the original and duplicate sample values are greater than or equal to 0.050 mg/l.

12.7 Prepare and analyze a matrix spike for each set of 20 samples of a similar matrix or with each batch, whichever is smaller. An acceptance criteria of 85 to 115 percent recovery is applied if the spike amount is greater than one fourth of the sample amount. If the matrix spike does not meet this criteria, then analyze the sample at a 1:5 dilution and a pH adjusted spike should be analyzed.

12.8 A spike blank or lab control must be prepared and analyzed for each set of 20 samples of a similar matrix or with each batch, whichever is smaller. The spike blank or lab control can be prepared using either soluble or insoluble hexavalent chromium as the spike. The acceptance range for the spike blank is 90 to 110 percent recovery. If the spike blank is not within that range, do not proceed. Check with the laboratory supervisor or manager for further directions.

13.0 DOCUMENTATION REQUIREMENTS

13.1 The analyst should document all relevant information, including all sample weights and volumes, digestion times and temperatures, all intermediate and final pH values, all times relevant to the pH adjustment process, all sample and background analysis results, and any relevant comments for any section of the digestion or analysis. Sample digestion and analysis sheets are provided.

13.2 For the analysis, all reagent identification numbers should be recorded on the sample worksheets. In addition, all reagent information such as lot numbers should also be recorded in the reagent logbook.

14.0 DATA REVIEW AND REPORTING

14.1 All samples should be updated to GP and GN batches in the LIMS system. The analyst should calculate all matrix spike, duplicate, external, and CCV recoveries and review the results of all blanks. These calculations may be automated or manual.

14.2 All documentation must be completed, including reagent references and spike amounts and spiking solution references.

14.3 A data file should be exported to the LIMS system and the spike amounts should be entered into the file at the GNAPP process step.

14.4 A final data package, consisting of the prep and analysis raw data, the LIMS cover page, the reagent reference pages, and the QC summary pages must be turned into the area supervisor or other senior reviewer for review.

14.5 After review by the supervisor, the data is released in the LIMS for access to the clients.

14.6 The department manager does an additional periodic review on the sample data as appropriate

15.0 POLLUTION PREVENTION & WASTE MANAGEMENT

15.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 15.2.

15.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, EHS004. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:

15.2.1 Non hazardous aqueous wastes

15.2.2 Hazardous aqueous wastes

15.2.3 Chlorinated organic solvents

15.2.4 Non-chlorinated organic solvents

15.2.5 Hazardous solid wastes

15.2.6 Non-hazardous solid wastes

16.0 ADDITIONAL REFERENCES

16.1 Refer to the spectrophotometer instrument manual(s) for additional information.

ACCUTEST LABORATORIES
STANDARD OPERATING PROCEDURE

Lab Manager:_____
QA Manager:_____

Effective Date:_____

TEST NAME: OXIDATION-REDUCTION POTENTIAL

METHOD REFERENCE: ASTM D1498-76 for waters. ASTM D1498-76 modified for soils.

Revised Sections: 9.3, 9.8.2, 9.8.3, 9.8.4

1.0 SCOPE AND APPLICATION

This method is based on ASTM method D1498-76 for waters and on a modification of this method for soils. The oxidation-reduction potential (ORP) of a process solution can be described as the millivolt (mV) signal produced when a noble metals electrode and a reference electrode are placed in water. The ORP measurement establishes the ratio of oxidants and reductants prevailing within a solution. The LIMS system product for oxidation-reduction potential is eH.

2.0 SUMMARY

Oxidation-reduction potential is measured using a meter with a combined oxidation-reduction and reference electrode. The meter is calibrated using a ferrous-ferric reference solution. The calibration is verified using quinhydrone buffer solutions. Samples are then measured with the calibrated electrode. The calibration is again verified with quinhydrone buffer solutions. The results are reported in mv versus a hydrogen electrode.

3.0 REPORTING LIMIT AND METHOD DETECTION LIMIT

No specific reporting limit or method detection limit values are in place for this method.

4.0 DEFINITIONS

BATCH: A group of samples which behave similarly with respect to the sampling or the testing procedures being employed and which are processed as a unit. For QC purposes, if the number of samples in a group is greater than 20, then each group of 20 samples or less will all be handled as a separate batch.

CALIBRATION CHECK STANDARD. The calibration check standard is a mid-range calibration standard. It is recommended that the calibration check standard be run at a frequency of approximately 10 percent. (For some methods this is mandatory and for some it is a recommendation only. Refer to individual method SOP's) For most methods, the mid-level calibration check standard criteria is + 10 percent of the true value. The exception to this rule is if the recovery on the calibration check standard is high and the samples to be reported are less than the detection limit.

MATRIX: The component or substrate (e.g., water, soil) which contains the analyte of interest.

MATRIX DUPLICATE: A duplicate sample is digested at a minimum of 1 in 20 samples. The relative percent difference (RPD) between the duplicate and the sample should be assessed. The duplicate RPD is calculated as shown below. Assess laboratory performance against the control limits that are specified in the SOP. In house limits are generated once sufficient duplicate data is available to generate limits (usually a minimum of 20 to 30 analyses). If a duplicate is out of control, flag the results with the appropriate footnote. If the sample and the duplicate are less than 5 times the reporting limits and are within a range of (the reporting limit, then the duplicate is considered to be in control. Note: If control limits are not specified in the SOP, use default limits of (20% RPD.

$$\frac{(|\text{Sample Result} - \text{Duplicate Result}|) \times 100}{(\text{Sample Result} + \text{Duplicate Result})/2} = \text{Duplicate RPD}$$

METHOD BLANK. The laboratory must digest and analyze a method blank with each set of samples. A minimum of one method blank is required for every 20 samples. For a running batch, a new method blank is required for each different digestion day. If no digestion step is required, then the method blank is equivalent to the reagent blank. The method blank must contain the parameter of interest at levels of less that the reporting limit for that parameter. If the method blank contains levels over the reporting limits, the samples must be redigested or redistilled and reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the method blank level. In addition, if all the samples are less than a client required limit and the method blank is also less than that limit, then the results can be reported as less than that limit.

REAGENT BLANK: The reagent blank is a blank that has the same matrix as the samples, i.e., all added reagents, but did not go through sample preparation procedures. The reagent blank is an indicator for contamination introduced during the analytical procedure. (Note: for methods requiring no preparation step, the reagent blank is equivalent to the method blank.) Either a reagent blank or a method blank must be analyzed with each batch of 20 samples or less. The concentration of the analyte of interest in the reagent blank must be less than the reporting limit for that analyte. If the reagent blank contains levels over the reporting limits, the samples must be reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the reagent blank level. In addition, if all the samples are less than a client required limit and the reagent blank is also less than that limit, then the results can be reported as less than that limit.

REAGENT GRADE: Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents, which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

REAGENT WATER: Water that has been generated by any method which would achieve the performance specifications for ASTM Type II water. For organic analyses, see the definition of organic-free reagent water.

REFERENCE MATERIAL: A material containing known quantities of target analytes in solution or in a homogeneous matrix. It is used to document the bias of the analytical process.

5.0 HEALTH & SAFETY

5.1 The analyst must follow normal safety procedures as outlined in the Accutest Laboratory Safety Manual which includes the use of safety glasses and lab coats. In addition, all acids are corrosive and must be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical must be treated as a potential health hazard. Exposure to these reagents must be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets must be made available to all personnel involved in these analyses.

6.0 SAMPLE COLLECTION, PRESERVATION, & STORAGE

6.1 Although this method does not specify a sample preservation procedure, it is recommended that both water and soils samples be stored under refrigeration at 4°C until analysis.

6.2 No specific holding time is specified in the method, but analyses should be done as soon as possible.

7.0 APPARATUS

7.1 pH meter with millivolt output scale. Thermo Orion Star Series or equivalent.

7.2 Oxidation-reduction electrode and reference electrode. Note: a combined electrode can be used which eliminates the need for a separate reference electrode is recommended. One acceptable electrode is the Platinum combination electrode from Fisher Scientific (cat. number 13-620-82) which consists of a platinum wire electrode with an electrolyte of 4M KCl saturated with AgCl.

7.3 Stir plate.

8.0 REAGENTS

8.1 Redox Standard Solution; Ferrous-Ferric Reference Solution. Dissolve 39.21 g of ferrous ammonium sulfate ($Fe(NH4)2(SO4)2.6H2O$), 48.22 g of ferric ammonium sulfate ($FeNH4(SO4)2.12H2O$) and 56.2 mL of sulfuric acid in water and dilute to 1 liter.

8.2 Redox Reference Solution; pH 4 Quinhydrone Solution. Mix 200 mL of pH 4 buffer solution with 2.0 g of Quinhydrone. Be sure that excess Quinhydrone is used in the solution so that solid crystals are always present. This solution is stable for only 8 hours.

8.3 Redox Reference Solution; pH 7 Quinhydrone Solution. Mix 200 mL of pH 7 buffer solution with 2.0 g of Quinhydrone. Be sure that excess Quinhydrone is used in the solution so that solid crystals are always present. This solution is stable for only 8 hours.

8.4 pH 4 buffer solution. A potassium hydrogen phthalate pH 4 buffer solution can either be made as described in ASTM 1498 or it can be purchased.

8.5 pH 7 buffer solution. A potassium dihydrogen phosphate/disodium hydrogen phosphate pH solution can either be made as described in ASTM 1498 or it can be purchased.

9.0 PROCEDURE

9.1 Attach the redox electrode to the pH meter and allow the meter to warm up.

9.2 Slide the mode switch to mv (millivolts) and place the electrode in the ferrous/ferric standard solution. Place a small stir bar in the bottom of the beaker and start it stirring gently.

9.3 Measure the millivolts of the solution and record on the worksheet. The ferrous-ferric reference solution should read back at 475 mv at 25 deg. C against the Ag/AgCl electrode. If the solution is not within 5 percent of this value do not continue. Check with the lab supervisor or manager for maintenance of the electrode. Additional electrolyte may need to be added to the electrode.

9.4 Press the cal switch on the pH meter. Both the cal 1 and the rel mv LED should light. The display should read 0.

9.5 Scroll in the ferrous-ferric reference solution value versus the hydrogen electrode (675 mv). Press enter. The meter is now ready for analysis. The absolute mv reading will give the mv versus the Ag/AgCl electrode. The relative mv reading will give the mv versus the standard hydrogen electrode. Both values should be recorded on the worksheet for the standards and for all samples.

9.5.1 The meter adds 200 mV to the absolute mv reading to obtaine the relative mv reading versus the standard hydrogen electrode. The difference between sample absolute and relative mv readings may vary slightly due to solution stability.

9.6 Check the redox measurements by measuring the ORP of the reference Quinhydrone solutions. All measurements should be done at 25 deg. C. The true values of the solutions are shown below. The measured values should be within 10 percent of the true values. If they are not, do not continue, but check with the lab supervisor to determine what corrective action is needed.

Solution	ORP vs Ag/AgCl (absolute mv)	ORP vs Hydrogen (relative mv)
pH 4 Quinhydrone solution	263	462
pH 7 Quinhydrone solution	86	285

9.7 For water samples, pour an aliquot of each sample into a plastic beaker and place a small stir bar in the sample. Slowly stir the sample. Place the electrode into the sample and measure both the absolute and the relative mv reading. Record the readings on the data sheet.

9.7.1 The difference between sample absolute and relative mv readings may vary slightly due to solution stability, but should be approximately 200 mv.

9.8 For soil samples, follow the procedure shown below.

9.8.1 Weigh out equal amounts of sample and DI water. Normally 50.0 g of sample and 50 mL of deionized water is used. If the sample is hygroscopic (i.e. absorbs water), then add water until the sample can be stirred and record the total volume of water added.

9.8.1.1 Smaller weights can be used if necessary, but the larger weight and volume is recommended for better sample reproducibility.

9.8.2 Hand mix the soil and water with a stirring rod or spatula thoroughly until a slurry is obtained. Make sure that there is no solid material on the bottom of the beaker while stirring.

9.8.3 Put in a stir bar and stir the sample on a stirring plate continuously for 5 minutes at a normal stirring speed. The sample should be mixing well, but there should not be a large vortex.

9.8.3.1 If the sample starts to cake on the bottom during the stirring procedure, hand stir the sample again so that it is as well suspended as possible before proceeding to setp 9.8.4.

9.8.3.2 If the sample contains oil and water, then let it settle and decant off the oily phase and measure the pH of the aqueous phase.

9.8.4 Slow the stirring speed to a slow stir. Place the electrode into the sample and measure both the absolute and the relative mv reading. Record the readings on the data sheet.

9.8.4.1 The difference between sample absolute and relative mv readings may vary slightly due to solution stability, but should be approximately 200 mv.

9.9 After every 10 samples, reanalyze the Quinhydrone solutions. Record both the absolute and relative mv readings. The readings should be within 10 percent of the true values.

10.0 QC REQUIREMENTS:

Below is a summary of the quality control requirements for this method. Make sure to check with the laboratory supervisor or manager for any additional client specific quality control requirements.

10.1 Matrix Duplicate. The laboratory must analyze a duplicate sample for a minimum of 1 in 20 samples. The relative percent difference (rpd) between the duplicate and the sample should be assessed. The duplicate rpd is calculated as shown below. The control limit for the duplicate recovery are calculated on an annual basis and are used to assess whether a duplicate is in control. Until sufficient duplicate data become available to determine control limits, the laboratory should assess laboratory performance of the duplicate against a relative percent difference of 20 percent. If a duplicate is out of control, then the results should be flagged with the appropriate footnote.

$$\frac{(\text{Sample Result} - \text{Duplicate Result}) \times 100}{(\text{Sample Result} + \text{Duplicate Result}) \times 0.5} = \% \text{ RPD}$$

10.2 Calibration Checks. The laboratory should analyze a reference or standard solution after approximately every 10 samples. The solution must be within 10 percent of the true value. If the check solution is outside of the acceptable range, then the problem must be corrected, the meter recalibrated and any affected samples reanalyzed and reported from an area with compliant calibration checks.

11.0 DOCUMENTATION REQUIREMENTS:

11.1 All sample results should be entered on a results worksheet. This worksheet should include all sample information and all quality control information. All reagent references should be included on or attached to this worksheet. In addition, any unusual characteristics of the samples should be noted.

11.2 Standards and Reagents. All standards and reagents must be recorded in the reagent log book.

12.0 DATA REVIEW AND REPORTING

12.1 All samples should be updated to QC batches in the LIMS system.

12.2 The analyst should calculate all duplicate RPD's and all check standard recoveries. All reagent references should be checked and included with the data write-up.

12.3 The data report should be turned in to the area supervisor for entry into the LIMS and data review.

13.0 POLLUTION PREVENTION & WASTE MANAGEMENT.

13.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors; liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 13.2.

13.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, EHS004. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:

13.2.1 Non hazardous aqueous wastes.

13.2.2 Hazardous aqueous wastes

13.2.3 Chlorinated organic solvents

13.2.4 Non-chlorinated organic solvents

13.2.5 Hazardous solid wastes

13.2.6 Non-hazardous solid wastes

14.0 ADDITIONAL REFERENCES.

14.1 Refer also to Standard Methods for the Examination of Water and Wastewater, Method 2580B.

ACCUTEST LABORATORIES
STANDARD OPERATING PROCEDURE

Lab Manager_____

QA Manager_____

Effective Date:_____

TITLE: **HARDNESS AS $CACO_3$ BY TITRATION**

REFERENCES: **Method 2340C from "Standard Methods for the Examination of Water and Wastewater", 19th Edition.**

Revised Sections: ***10.4, 10.4.1, 12.3***

1.0 SCOPE AND APPLICATION

1.1 This method is used as a measure of the hardness in a sample and is applicable to all waters and wastewaters.

1.2 The product for hardness is HRD.

1.3 An alternate method for hardness, where the hardness value is calculated from calcium and magnesium values, is cited in the SOP EGN259.

2.0 SUMMARY

2.1 A measured aliquot of sample is buffered and then titrated with standardized EDTA (disodium ethylenediamine tetraacetate) titrant. The end point of the reaction is determined when the last reddish tint in the sample disappears. The indicator has a red color in the presence of calcium and magnesium ions and a blue color when these ions are sequestered.

3.0 REPORTING LIMIT AND METHOD DETECTION LIMIT

3.1 Reporting Limit. The reporting limit for this method has been established at 4.0 mg/l of hardness as calcium carbonate.

3.2 Method Detection Limit. Experimentally determine MDLs using the procedure specified in 40 CFR, Part 136, Appendix B. This value represents the lowest reportable concentration of an individual compound that meets the method qualitative identification criteria.

3.2.1 Experimental MDLs must be determined annually for this method.

4.0 DEFINITIONS

BATCH: A group of samples which behave similarly with respect to the sampling or the testing procedures being employed and which are processed as a unit. For QC purposes, if the number of

samples in a group is greater than 20, then each group of 20 samples or less will all be handled as a separate batch.

EXTERNAL CHECK STANDARD. The external check standard is a standard from a separate source than the calibration curve or the spike blank that is used to verify the accuracy of the method. An external check must be run a minimum of once per quarter for all analyses where a check is commercially available. The laboratory should initially assess laboratory performance of a check standard using the control limits generated by the external check supplier. In house limits should also be generated once sufficient external check standard data is available to generate limits (usually a minimum of 20 to 30 analyses). If the external check is outside of the control limits for a given parameter, all samples must be reanalyzed for that parameter after the problem has been resolved.

SPIKE BLANK OR LAB CONTROL SAMPLE. Digest and analyze a laboratory control sample or spike blank with each set of samples. A minimum of one lab control sample or spike blank is required for every 20 samples. Assess laboratory performance against the control limits specified in the SOP. In house limits should also be generated once sufficient external check standard data is available to generate limits (usually a minimum of 20 to 30 analyses). If the lab control is outside of the control limits for a parameter, all samples must be redigested or redistilled and reanalyzed for that parameter. The exception is if the lab control recovery is high and the results of the samples to be reported are less than the reporting limit. In that case, the sample results can be reported with no flag. Note: If control limits are not specified in the SOP, then default limits of 80 to 120 percent should be used.

MATRIX: The component or substrate (e.g., water, soil) which contains the analyte of interest.

MATRIX DUPLICATE: A duplicate sample is digested at a minimum of 1 in 20 samples. The relative percent difference (RPD) between the duplicate and the sample should be assessed. The duplicate RPD is calculated as shown below. Assess laboratory performance against the control limits that are specified in the SOP. In house limits are generated once sufficient duplicate data is available to generate limits (usually a minimum of 20 to 30 analyses). If a duplicate is out of control, flag the results with the appropriate footnote. If the sample and the duplicate are less than 5 times the reporting limits and are within a range of ± the reporting limit, then the duplicate is considered to be in control. Note: If control limits are not specified in the SOP, use default limits of ± 20% RPD.

$$\frac{(|\text{Sample Result} - \text{Duplicate Result}|) \times 100}{(\text{Sample Result} + \text{Duplicate Result})/2} = \text{Duplicate RPD}$$

MATRIX SPIKE: The laboratory must add a known amount of each analyte to a minimum of 1 in 20 samples. The matrix spike recovery is calculated as shown below. Assess laboratory performance against the control limits that are specified in the SOP. In house limits are generated once sufficient matrix spike data is available to generate limits (usually a minimum of 20 to 30 analyses). If a matrix spike is out of control, then the results should be flagged with the appropriate footnote. If the matrix spike amount is less than one fourth of the sample amount, then the sample cannot be assessed against the control limits and should be footnoted to that effect. Note: If control limits are not specified in the SOP, then default limits of 75 to 125 percent should be used.

$$\frac{(\text{Spiked Sample Result} - \text{Sample Result})}{(\text{Amount Spiked})} \times 100 = \text{Matrix Spike Recovery}$$

METHOD BLANK. The laboratory must digest and analyze a method blank with each set of samples. A minimum of one method blank is required for every 20 samples. For a running batch, a new method blank is required for each different digestion day. If no digestion step is required, then the method blank is equivalent to the reagent blank. The method blank must contain the parameter of interest at levels of less that the reporting limit for that parameter. If the method blank contains levels over the reporting limits, the samples must be redigested or redistilled and reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the method blank level. In addition, if all the samples are less than a client required limit and the method blank is also less than that limit, then the results can be reported as less than that limit.

METHOD DETECTION LIMITS (MDLS). MDLs should be established for all appropriate methods, using a solution spiked at approximately 3 times the estimated detection limit. To determine the MDL values, take seven replicate aliquots of the spiked sample and process through the entire analytical method. The MDL is calculated by multiplying the standard deviation of three replicate analyses by 3.14, which is the student's t value for a 99% confidence level. MDLs should be determined approximately once per year for frequently analyzed parameters.

REAGENT GRADE: Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

REAGENT WATER: Water that has been generated by any method which would achieve the performance specifications for ASTM Type II water. For organic analyses, see the definition of organic-free reagent water.

REFERENCE MATERIAL: A material containing known quantities of target analytes in solution or in a homogeneous matrix. It is used to document the bias of the analytical process.

5.0 HEALTH & SAFETY

5.1 The analyst should follow normal safety procedures as outlined in the Accutest Laboratory Safety Manual which includes the use of safety glasses and lab coats. In addition, all acids are corrosive and should be handled with care. Flush spills with plenty of water. If acids contact any part of the body, flush with water and contact the supervisor

5.2 The toxicity or carcinogenicity of each reagent used in this method has not been precisely determined; however, each chemical should be treated as a potential health hazard. Exposure to these reagents should be reduced to the lowest possible level. The laboratory is responsible for maintaining a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. A reference file of data handling sheets should be made available to all personnel involved in these analyses.

6.0 COLLECTION, PRESERVATION, & HOLDING TIME

6.1 Water samples should be acidified to a pH of less than 2 by the addition of concentrated nitric acid.

6.2 All samples should be analyzed within 6 months of the date of collection.

7.0 APPARATUS & MATERIALS

7.1 25 ml microburet, class A.

7.2 Erlenmeyer flasks or disposable beakers

7.3 Stir plates and stir bars.

7.4 Analytical balance, 4 place. The balance calibration must be checked daily before use. If the calibration checks on the balance are not within limits as supplied in the balance logs, then the balance must be taken out of service until it can be recalibrated.

7.5 Narrow range pH paper to read between 10.0 and 10.1.

8.0 STANDARDS & REAGENTS.

8.1 All chemicals listed below are reagent grade unless otherwise specified. Distilled water should be used whenever water is required.

8.2 Buffer solution. Dissolve 1.179 g of analytical grade disodium EDTA (disodium ethylenediamine tetraacetate, $Na_2C_{10}H_{14}O_8N_2 \cdot 2H_2O$) and 0.780 g of $MgSO_4 \cdot 7H_2O$ (or 0.644 g of $MgCl_2 \cdot 6H_2O$) in 50 ml of DI water. Add this solution to a 250 ml volumetric flask containing 16.9 g of ammonium chloride (NH_4Cl) and 143 ml of concentrated ammonium hydroxide (NH_4OH) with mixing and dilute to the mark with DI water. Store in a plastic bottle for no longer than 1 month.

8.2.1 Anhydrous magnesium chloride may also be used in the above buffer solution as long as the weights are adjusted accordingly.

8.2.2 An alternate buffer solution may be prepared by dissolving 16.9 g of ammonium chloride (NH_4Cl) in 143 ml of concentrated ammonium hydroxide (NH4OH). Add 1.25 g of magnesium salt of EDTA (available commercially) and dilute to 250 ml with DI water. Mix well

8.2.3 Commercial buffer solutions are also available. Refer to the method for additional information on these buffer solutions.

8.2.4 One to 2 ml of buffer with the sample should give a pH of 10.0 to 10.1. If the buffer is not obtaining that pH on most samples, it may have deteriorated and fresh buffer should be made.

8.3 Inhibitor solutions. These are to be used only if interferences are evident during the titration. These inhibitor solutions help to give a clear sharp change in color at the end point. Check with the lab supervisor or manager before using any of these inhibitor solutions

8.3.1 Inhibitor I: NaCN powder. (Caution – extremely poisonous). Flush solutions of sample containing this solution down the drain using large quantities of water. Make

sure that there are no acids present that might liberate HCN. Always work in the hood when using this solution.

8.3.2 Inhibitor II: Dissolve 5.0g of $Na_2S \cdot 9H_2O$ in 100 ml of DI water. Cover container with a tightly fitted rubber stopper. This inhibitor deteriorates through air oxidation and can produce a sulfide precipitate that obscures the end point when appreciable concentrations of heavy metals are present.

8.3.3 Inhibitor III: MgCDTA (magnesium salt of 1,2-cylclohexanediamnetetraacetic acid). Add 0.250 g of MgCDTA to each 100 ml of sample before analysis and dissolve completely before adding the buffer solution.

8.4 Indicator. Solid calmagite (1-(1-hydroxy-4-methyl-2phenylazo)-2-maphthol-4-sulfonic acid or a calmagite indicator solution can be used.

8.4.1 Calmagite solution can be prepared by dissolving 0.10 g of Calmagite in 100 ml of DI water.

8.5 Standard EDTA titrant, 0.020 N (0.010 M). Place 3.723 g of analytical grade disodium EDTA in a 1 liter volumetric flask and dilute to the mark with DI water. Check with standard calcium solution by titration as described in the procedure section below. Store in a polyethylene bottle.

8.6 Standard Calcium solution (1000 mg/l). Place 1.000 g of anhydrous calcium carbonate in a 500 ml erlenmeyer flask. Slowly add 1+1 HCl until all of the calcium carbonate has dissolved. Add 200 ml of DI water and boil for several minutes to expel the carbon dioxide. Cool. Then add a few drops of methyl red indicator and adjust to an intermediate orange color by adding 3N ammonium hydroxide or 1 +1 HCl as required. Transfer quantitatively to a 1 liter volumetric flask and dilute to a final volume of 1 liter with DI water. Mix well.

8.7 Hydrochloric acid solution, 1+1. Add one part hydrochloric acid to one part water.

8.8 Methyl Red Indicator. Dissolve 0.10 g of methyl red in DI water in a 100 ml volumetric flask and dilute to the final volume with DI water and mix well. This may also be purchased commercially.

8.9 Ammonium Hydroxide solution, 3 N. Dilute 210 ml of concentrated ammonium hydroxide (NH_4OH) to 1 liter with DI water.

8.10 Ammonium hydroxide solution, 1N. Dilute 70 ml of concentrated ammonium hydroxide to 1 liter with DI water.

9.0 INTERFERENCES

9.1 Some metal ions interfere by causing fading or indistinct endpoints or by stoichiometric comsumption of EDTA. These interferences can be reduced by adding certain inhibitors before titration.

9.2 Conduct titrations at or near room temperature. Color change may be impractically slow at low temperatures.

9.3 Calcium carbonate precipitation may cause a drifting endpoint. Completion of the titration within 5 minutes minimizes the tendency for calcium carbonate to precipitate. Dilution can also minimize this problem. Alternatively, do a preliminary titration and add 90 percent of the expected titrate to the sample before adjusting the pH with the buffer. Then finish the titration.

10.0 PROCEDURE

10.1 Check the standardization of the EDTA solution and make sure that it has been standardized within the past month. If it has not been standardized within a month, or if it is a new lot of EDTA, standardize the solution following the procedure outlined below.

10.1.1 Place 10.0 ml of standard calcium solution in a container containing about 50 ml of DI water. Add 1 ml of the buffer solution and a few crystals of calgamite. Titrate slowly with continuous stirring with the EDTA until the last reddish tinge disappears. Add the last few drops at 3 to 5 second intervals. At the end point, the color should be blue. The total titration duration should be no more than 5 minutes from the time of the buffer addition.

10.1.2 Calculate the normality of the EDTA as shown below.

N of EDTA = (0.200)/(ml of EDTA added)

10.2 Start the titration of the samples and the quality control. A method blank and a spike blank must be analyzed at the beginning of every run and a second spike blank must be analyzed with every 10 additional samples. (For example, if you are running 20 samples, you should analyze a spike blank at the beginning of the run and after the first 10 samples.) A duplicate and a matrix spike must be analyzed with every 20 samples. For some clients and some states, additional QC may be required. (10% duplicates are required for New York samples.)

10.3 Measure 25.0 ml of sample or quality control into the titration vessel. Blank spikes and matrix spikes should be spiked with 4.00 ml of the standard calcium carbonate solution at this point. Neutralize the samples with 1 N ammonium hydroxide and dilute to a final volume of approximately 50 ml.

10.3.1 Highly polluted samples should first go through a metals digestion step before analysis. Check with the lab supervisor or manager if you feel the sample needs extra pretreatment.

10.4 Add 1 to 2 ml of buffer solution and mix. The pH of the samples at this point should be 10.0 to 10.1. Check the pH with narrow range pH paper and verify that it is within the range of 10.0 to 10.1. Document that the pH is within range on the sample worksheet. Then add a few grains of the Calgamite to each sample.

10.4.1 If the pH is not within range, add additional buffer or use a smaller sample size and recheck the pH. Do not proceed with the titration until the pH is within the required range.

10.5 Titrate the sample slowly with continuous stirring with the standard EDTA titrant until the last reddish tint disappears. The solution is normally blue at the end point. Note: Make sure that the titration is complete within 5 minutes of the time that the buffer solution is added in order to minimize calcium carbonate precipitation.

10.5.1 If the endpoint is indistinct or fades, an inhibitor may be needed. Check with the lab supervisor or manager and refer to Standard Methods 2340C, Section 2B. Add the inhibitor immediately after the addition of the buffer and proceed with the analysis as outlined above.

10.6 Calculate the final results using the equation shown below. Make sure to use the normality and not the molarity of the EDTA titrant in this calculation.

Hardness as mg $CaCO_3$/liter = (A x N X 50000)/(ml sample)

Where
A = ml of EDTA titrant
N = normality of EDTA titrant.

11.0 QUALITY CONTROL

Below is a summary of the quality control requirements for this method. Make sure to check with the laboratory supervisor or manager for any additional client specific quality control requirements.

11.1 Method Detection Limits (MDLs). MDLs should be established using a solution spiked at approximately 3 times the estimated detection limit. To determine the MDL values, take seven replicate aliquots of the spiked sample and process through the entire analytical method. The MDL is calculated by multiplying the standard deviation of the replicate analyses by 3.14, which is the student's t value for a 99% confidence level . MDLs should be determined approximately once per year or whenever there is a significant change in the background or instrument response.

11.2 Quality Control Sample (also referred to as the external). At a minimum of once per quarter, a standard from a different source than the spike blank must be analyzed. Note: It is recommended that this standard be analyzed with each run if sufficient standard is available. This sample should be within the manufacturers limits. If no manufacturer's limits are available, then default limits of 90 to 110% should be applied.

11.3 Method Blank. The laboratory must digest and analyze a method blank with each set of samples. A minimum of one method blank is required for every 20 samples or on each analysis day. The method blank must contain hardness as calcium carbonate at a level less than the reporting limit. If the method blank contains over that limit, the samples must be reanalyzed. The exception to this rule is when the samples to be reported contain greater than 10 times the method blank level. In addition, if all the samples are less than a client required limit and the method blank is also less than that limit, then the results can be reported as less than that limit.

11.4 Spike Blank. The laboratory must analyze a spike blank with each set of 10 samples. The laboratory should assess laboratory performance of the spike blank against recovery limits of 80 to 120 percent. If the spike blank recovery is high and the results of the samples to be

reported are less than the reporting limit, then the sample results can be reported with no flag. Otherwise, all associated samples must be reanalyzed.

11.5 Matrix Spike. The laboratory must add a known amount of each analyte to a minimum of 1 in 20 samples. The spike recovery should be assessed using in house limits. Until these limits can be generated, then default limits of 75 to 125 percent recovery should be applied. If a matrix spike is out of control, then the results should be flagged with the appropriate footnote. If the matrix spike amount is less than one fourth of the sample amount, then the sample cannot be assessed against the control limits and should be footnoted to that effect. The matrix spike recovery should be calculated as shown below.

$$\frac{\text{(Spiked Sample Result - Sample Result)}}{\text{(Amount Spiked)}} \times 100 = \text{MS Recovery}$$

11.6 Matrix Duplicate. The laboratory must digest a duplicate sample for a minimum of 1 in 20 samples. The relative percent difference (rpd) between the duplicate and the sample should be assessed. The duplicate rpd is calculated as shown below.

11.6.1 The duplicate RPD should be assessed using in house limits. Until these limits can be generated, then default limits of 20 percent RPD should be applied. If a duplicate is out of control, then the results should be flagged with the appropriate footnote. If the sample and the duplicate are less than 5 times the reporting limits and are within a range of $\pm$ the reporting limit, then the duplicate is considered to be in control.

11.6.2 The duplicate RPD should be calculated as shown below.

$$\frac{\text{(Sample Result - Duplicate Result)} \times 100}{\text{(Sample Result + Duplicate Result)} \times 0.5} = \text{\% RPD}$$

12.0 DOCUMENTATION

12.1 All reagent and standard information, including the manufacturer, lot, and expiration date should be recorded in a general chemistry reagent log.

12.2 Reagent and standard reference numbers should be recorded all on analysis write-ups.

12.3 All initial volumes, dilutions, and final volumes should be recorded on the analysis write-ups. The verification of the pH after the addition of the buffer should also be documented on the analysis write-up.

12.4 Any problems or comments about the samples should be included on the analysis write-ups.

12.5 Balance checks and calibrations should be recorded on the balance logs provided with each balance. Each balance must be checked at least once per day before use. The balance checks should be within the criteria listed in the balance log book.

13.0 DATA REPORTING

13.1 All samples should be updated to QC batches in the LIMS system. The analyst should calculate all duplicate RPD's and spike recoveries.

13.2 All documentation must be completed. The data report should be turned in to the area supervisor for review.

14.0 POLLUTION PREVENTION & WASTE MANAGEMENT.

14.1 Users of this method must perform all procedural steps in a manner that controls the creation and/or escape of wastes or hazardous materials to the environment. The amounts of standards, reagents, and solvents must be limited to the amounts specified in this SOP. All safety practices designed to limit the escape of vapors, liquids or solids to the environment must be followed. All method users must be familiar with the waste management practices described in section 14.2.

14.2 Waste Management. Individuals performing this method must follow established waste management procedures as described in the waste management SOP, ESM003. This document describes the proper disposal of all waste materials generated during the testing of samples as follows:

14.2.1 Non hazardous aqueous wastes.

14.2.2 Hazardous aqueous wastes

14.2.3 Chlorinated organic solvents

14.2.4 Non-chlorinated organic solvents

14.2.5 Hazardous solid wastes

14.2.6 Non-hazardous solid wastes

15.0 REFERENCES

15.1 No additional references were required for this method.

Mercury Determination in Tissue and Soil/Sediment Samples by Cold Vapor Atomic Fluorescence Technique (CVAF)

References: **Method 7474,** Mercury in Sediment and Tissues by Atomic Fluorescence Spectrometry. SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Revision 0, Update IV, 1998.

Method 7471A, Mercury in Solid or Semisolid Waste (Manual Cold Vapor Technique). SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Revision 1, 1994.

Determination of Mercury in Seawater at Sub-Nanogram per Liter Levels. Bloom, N.S. and E.A. Crecilius, Marine Chemistry, 14, 49-59. 1983.

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Name: Joseph Watkins Position: Laboratory/Technical Director

Signature: Joseph Watkins Date: 7/11/11

ISSUE AMENDMENTS

Changes since last issue:

Edited signatories.

Sections 9.5 and 11: Edited QC Acceptance Criteria.

Mercury Determination in Tissue and Soil/Sediment Samples by Cold Vapor Atomic Fluorescence Technique (CVAF)

References: **Method 7474,** Mercury in Sediment and Tissues by Atomic Fluorescence Spectrometry, SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Revision 0, Update IV, 1998.

Method 7471A, Mercury in Soild or Semisolid Waste (Manual Cold Vapor Technique), SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA SW-846, Revision 1, 1994.

Determination of Mercury in Seawater at Sub-Nanogram per Liter Levels. Bloom, N.S. and E.A. Crecilius, Marine Chemistry, 14, 49-59. 1983.

1. Scope and Application

Matrices: The method is applicable to total mercury in tissue and soil/sediment samples.

Definitions: Refer to Alpha Analytical Quality Manual.

Two procedures for the analysis of mercury by cold vapor atomic fluorescence spectrometry are discussed in this SOP.

Mercury in Tissues - This method utilizes a microwave digestion followed by bromine chloride oxidation. Samples are then decolorized using hydroxylamine hydrochloride and analyzed following reduction with stannous chloride. Elemental mercury is then purged from solution and analyzed by atomic fluorescence spectrometry.

Mercury in Soil/Sediments - This method utilizes a hot plate digestion with aqua regia followed by bromine chloride oxidation. Samples are then decolorized using hydroxylamine hydrochloride and analyzed following reduction with stannous chloride. Elemental mercury is then purged from solution and analyzed by atomic fluorescence spectrometry.

The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

This method is restricted to use by or under the supervision of analysts experienced in the operation of the Mercury analyzer and in the interpretation of Mercury data. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability, analyzing a proficiency test sample and completing the record of training.

After initial demonstration, ongoing demonstration is based on acceptable laboratory performance of at least a quarterly laboratory control sample or acceptable performance from an annual proficiency test sample. A major modification to this procedure requires demonstration of performance. The identification of major method modification requiring performance demonstration is directed by the Quality Assurance Officer and/or Laboratory Director on a case-by-case basis.

Parameter	CAS
Mercury	7439-97-6

2. Summary of Method

Mercury in tissue samples is determined by cold vapor atomic fluorescence spectrometry from an aliquot of a microwave digestion (see SOP MP-003). A 10 mL aliquot of the digest is added to a 50 mL screw cap polyethylene digestion tube along with 2 mL of an acidic bromine chloride solution. Bromine chloride is prepared by mixing potassium bromide with potassium bromate solutions with hydrochloric acid producing a yellow solution. Bromine chloride is know to oxidize inorganic and organomercury compounds. If a yellow color does not persist after addition of bromine chloride, then additional solution must be added until a yellow color persists. The same volume of bromine chloride solution is added to all samples and standards. This solution is allowed to stand for at least 12 hours. After digestion is complete, bring to 50 mL, add 0.4 mL of 12% hydroxyl amine hydrochloride solution and shake. Additional hydroxyl amine hydrochloride is added if the yellow color from the bromine chloride solution persists.

Samples and standards are placed in the autosampler rack for analysis following stannous chloride reduction and analysis by cold vapor atomic fluorescence spectrometry at a wavelength of 253.7 nm.

Mercury in soil/sediment samples is determined by cold vapor atomic fluorescence spectrometry from a hot plate digestion utilizing aqua regia. A 0.5 – 1 g wet sediment aliquot is added to a 50 mL screw cap polyethylene digestion tube along with 5 mL of DI water, 3.75 mL concentrated HCl and 1.25 mL of concentrated HNO_3. Samples are heated on the hot block for 2 minutes and allowed to cool. 25 mL of Di water are then added, the samples placed back on the hot block and heated for 30 minutes. The samples are then cooled and brought to 50 mL with DI water. A 10 mL aliquot of the digest is added to a 50 mL digestion tube along with 2 mL of an acidic bromine chloride solution. If a yellow color does not persist after addition of bromine chloride then additional solution must be added until a yellow color persists. The same volume of bromine chloride solution is added to all samples and standards. This solution is allowed to stand for at least 12 hours. After digestion is complete, bring to 50 mL, add 0.4 mL of 12% hydroxyl amine hydrochloride solution and shake. Additional hydroxyl amine hydrochloride is added if the yellow color from the bromine chloride solution persists.

Samples and standards are placed in the autosampler rack for analysis following stannous chloride reduction and analyzed by cold vapor atomic fluorescence spectrometry at a wavelength of 253.7 nm.

2.1 Method Modifications from Reference

Method 7474 calls for a microwave digestion for both tissues and soils/sediments with nitric and hydrochloric acids. The method has been modified for tissues to use an aliquot of a microwave digest utilizing nitric acid only. The method has been modified for soils/sediments to use a hot block digestion similar to that used for Method 7471A but without the addition of potassium permanganate. The change allows for more rapid preparation of samples and yields equivalent data to the reference method as indicated by the performance of PT samples.

The procedure used to prepare the bromine chloride solution has been modified from the method reference to that used in the Bloom and Crecelius, 1983 reference. The solution is equivalent the reference method and requires less time to make. There is no impact to the data as indicated by the performance of PT samples.

3. Reporting Limit

The Reporting limit for mercury in tissues is 0.05 µg/L (0.0125 mg/kg) and the linear range of the analysis is 10 µg/L (2.5 mg/kg).

The Reporting limit for mercury in soil/sediment is 0.05 µg/L (0.0125 mg/kg) and the linear range of the analysis is 10 µg/L (0.5 mg/kg).

4. Interferences

4.1 Gold, silver and iodide are known interference.

4.1.1 High concentrations of gold and silver in a sample may suppress mercury reduction.

4.1.2 Samples with iodide concentrations greater than 3 mg/L should be pre-reduced with stannous chloride to clarify the brown color. It may be necessary to clean the analytical system with 4N HCl following analysis of a sample with iodide concentrations greater than 30 mg/L.

4.1.3 Sulfide concentrations up to 24 mg/L produce no interference problems.

5. Health and Safety

The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

The use of laboratory equipment and chemicals exposes the analyst to several potential hazards. Good laboratory techniques and safety practices shall be followed at all times. Eating, drinking, smoking, or the application of cosmetics is not permitted in the laboratory area. Horseplay of any kind is prohibited. Pipetting by mouth is not permitted. All Personal Protective Equipment (PPE) must be removed before leaving the laboratory area and before entering the employee lounge or eating area. Always wash your hands before leaving the laboratory. All relevant Material Safety Data Sheets (MSDSs) are kept alphabetically in a centrally located file storage.

Approved PPE, which includes Safety Glasses, Gloves and Lab Coats, must be worn at ***all*** times when handling samples, reagents, chemicals, or when in the vicinity of others handling these items, so that dermal contact is avoided. All standards, reagents and solvents shall be handled under a hood using the proper PPE. All flammable solvents must be kept in the flammable storage cabinet, and returned to the cabinet immediately after use. When transporting chemicals, use a secure transporting device and/or secondary outer container. Chemical storage is properly segregated and adequately ventilated to reduce the possibility of hazardous reactions. Chemical storage in work areas shall be kept to a minimum. Storage on bench tops or other work surfaces, except temporary, is not permitted.

Spilled samples, solvents, reagents, and water must be cleaned up from bench tops, instruments and autosampler surfaces immediately. A spill is considered a quantity of hazardous material if it is moderate to extreme hazard to the skin and mucous membranes. If contact with the skin occurs, immediately flush with large volumes of water. In the case of acidic/basic spills, the *Spill Kit* located in each laboratory shall be utilized before attempting to cleanup the spill. Although procedures are designed to minimize the possibility of an accident, all injuries or accidents, regardless of the nature or severity, are to be reported to the Department Manager Supervisor immediately. If an employee discovers a potentially unsafe condition, this must be reported to the Department Manager Supervisor immediately. No employee should feel compelled to work in a situation where they do not feel entirely informed, trained, or safe.

Analytical instrumentation poses the unique possibility of exposure to high voltages. Other than the *routine* instrument maintenance, as listed in the front of every Instrument Maintenance Logbook, at no time shall an instrument operator attempt to maintenance an instrument alone, or without the proper training, supervision or instruction. Caution must always be used in the presence of moving parts (autosamplers) and hot surfaces (injection ports).

Compressed gas cylinders shall only be moved with the dolly supplied for this specific purpose. The cap must be on the cylinder while it is being moved. The tank must be secured when in its final position. All spent tanks are to be returned in the same manner, and secured until removed by the vendor. Liquid argon or nitrogen represents a potential cryogenic hazard and safe-handling procedures must be used at all times.

All additional company safety practices shall be followed at all times as written in the *Chemical Hygiene Plan*.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection

A minimum of 10g of sample must be collected in a pre-cleaned 2oz or 4oz glass jar with a Teflon lined screw cap.

6.2 Sample Preservation

No preservatives are used. See Section 6.4.

6.3 Sample Shipping

No special sample shipping requirements.

6.4 Sample Handling

Samples are stored at 4°C ± 2°C. The hold time for soil/sediment and tissue samples is 28 days. Sediment and tissue samples may be stored frozen at -20°C ± 10°C. The hold time for solid samples stored frozen may be extended unless specifically noted by project or client requirements.

7. Equipment and Supplies

7.1 Instrument: The PSA Millennium Merlin Atomic Fluorescence Analyzer equipped with a PC loaded with instrumental software, gold-amalgamation attachment (Millennium Gallahad) and PSA 20.400 autosampler. The instrument is connected to a source of high-purity, mercury free argon regulated to 50 PSI.

7.2 Santoprene Peristaltic Pump Tubing: Green/Green (PSA part number M025T002 or equivalent) for blank and autosampler rinse, Grey/Grey (PSA part number M055T005 or equivalent) for sample and stannous chloride.

7.3 Electric Hot Plate: Adjustable and capable of maintaining a temperature of 90-95°C equipped with graphite carbon blocks that each have 36 positions to hold the sample tubes.

NOTE: Hotplate/Block temperatures are monitored regularly using NIST calibrated and traceable thermometers. If any thermometer is suspected to not be reading the temperatures correctly, it is replaced with another certified thermometer.

7.4 Milestone Ethos E Microwave Oven: Equipped with temperature control probe and high pressure perfluoropolymer vessels.

7.5 Digestion Tubes: 50mL disposable polyethylene screw cap digestion tubes.

7.6 Other: Adjustable Eppendorf pipettes and replacement tips

8. Reagents and Standards

ACS Trace Metal grade chemicals shall be used in all tests. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination. If the purity of a reagent is in question, analyze for contamination. If the concentration is less than the MDL then the reagent is acceptable.

Solutions below expire six months from preparation unless noted.

Stock standard solutions are stored in a cabinet, out of direct light

8.1 Deionized (DI) water: The Barnstead NANO-pure system provides Type I water used in the preparation of samples and standards.

8.2 Hydrochloric acid, concentrated (HCl): ACS reagent grade, Fisher #A508-212, or equivalent. Hydrochloric acid (1:1 HCl) - Add 500mL concentrated HCl to 400mL DI water and dilute to 1L. 10% HCl – Add 100 mL concentrated HCl to approximately 500 mL DI and bring to 1 L with DI. Lots should be checked for purity prior to use and the results stored in a reagent check log book.

8.3 Nitric acid, concentrated (HNO_3): ACS reagent grade, Fisher #A509-212, or equivalent. Nitric Acid (1:1 HNO_3) - Add 500mL concentrated HNO_3 to 400mL DI water and dilute to 1L. Prepare 1% Nitric Acid by diluting 1mL of concentrated HNO_3 up to 100mL in DI water. Lots should be checked for purity prior to use and the results stored in a reagent check log book.

8.4 Hydroxylamine hydrochloride ($NH_2OH{\cdot}HCl$): ACS reagent grade, VWR #HX0770-1, or equivalent. Prepare 12% solution by adding 12 g per 100 mL of DI.

8.5 Stannous Chloride ($SnCl_2{\cdot}H_20$): ACS reagent grade, Fisher #T142-500, or equivalent. Prepare 2% solution by adding 20 g to 1L of 10% HCl. Prepare daily. Solution may be purged with argon at 2 L/minute for 30 minutes to remove Hg impurities.

8.6 Potassium Bromate ($KBrO_3$): ACS grade, Fisher #P207-250. May be baked in muffle furnace at 250°C for 8 hours to remove mercury impurities.

8.7 Potassium Bromide (KBr): ACS grade, Fisher #P205-500. May be baked in muffle furnace at 250°C for 8 hours to remove mercury impurities.

8.8 Bromine Chloride (BrCl): Prepare in a BOD bottle under a fume hood by adding 1.5 g KBr and 1.1 g $KBrO_3$ to 20mL DI water and mix. Slowly add 80mL of concentrated HCl and mix. Solution will turn yellow. **Free Halogens are generated from this solution. Seal the bottle when taking out of fume hood.**

8.9 Stock and Working Standards:

The 1000 µg/L working standards must be prepared in the same manner as samples. These standards are then diluted to make calibration and calibration check standards. After preparation, the 1000 µg/L working standards can be used for one week.

8.9.1 1000 mg/L Stock Calibration Mercury Standard: Ultra Scientific #ICP-080, or equivalent.

8.9.1.1 **1000 µg/L Working Standard for Tissues:** Prepare by adding 0.05mL of 1000 mg/L stock to a microwave digestion vessel containing 10mL of concentrated HNO_3. This standard is digested along with samples according to Method 3051 (SOP MP-003). The standard is then brought to a 50mL final volume with DI water in a screw cap digestion tube. This standard is identified as **C-date-VM** in the Mercury Standards Preparation Log.

8.9.1.2 **1000 µg/L Working Standard for Soils/Sediments:** Prepare by adding 0.05 mL of 1000 mg/L stock (Section 8.9.1) to a 50 mL screw cap digestion tube containing 5 mL of DI water, 1.25 mL of concentrated HNO_3 and 3.75 mL of concentrated HCl. This standard is digested along with samples. The standard is then brought to a 50 mL final volume with DI water. This standard is identified as **C-date-VH** in the Mercury Standards Preparation Log.

8.9.1.3 **100 µg/L Intermediate Standard:** Prepare by adding 0.1 mL of the 1000 µg/L working standard (Section 8.9.1.1 or 8.9.1.2) to 0.9 mL DI water. This intermediate standard is used for calibration standards preparation and then discarded.

8.9.1.4 **10 µg/L Intermediate Standard:** Prepare by adding 0.1 mL of the 100 µg/L working standard (Section 8.9.1.3) to 0.9 mL DI. This intermediate standard is used for calibration standards preparation and then discarded.

8.9.1.5 **5 µg/L Intermediate Standard:** Prepare by adding 0.25 mL of the 1000 µg/L working standard (Section 8.9.1.1 or 8.9.1.2) to 50 mL graduated digestion tube containing 2% HCl. Bring to 50 mL final volume.

8.9.2 **1000 mg/L Stock ICV Mercury Standard:** Inorganic Ventures #CGHG-1, or equivalent

8.9.2.1 **1000 µg/L ICV Working Standard for Tissues:** Prepare by adding 0.05 mL of 1000 mg/L stock to a microwave digestion vessel containing 10 mL of concentrated HNO_3. This standard is digested along with samples according to Method 3051 (SOP-MP-003). The standard is then brought to a 50 mL final volume with DI water in a screw cap digestion tube. This standard is identified as **I-date-VM** in the Mercury Standards Preparation Log.

8.9.2.2 **1000 µg/L ICV Working Standard for Soils/Sediments:** Prepare by adding 0.05 mL of 1000 mg/L stock to a 50 mL screw cap digestion tube containing 5 mL of DI water, 1.25 mL of concentrated HNO_3 and 3.75 mL of concentrated HCl. This standard is digested along with samples. The standard is then brought to a 50 mL final volume with DI water. This standard is identified as I-date-VH in the Mercury Standards Preparation Log.

8.9.2.3 **5 µg/L Intermediate Standard:** Prepare by adding 0.25 mL of the 1000 µg/L working standard (Section 8.9.2.1 or 8.9.2.2) to 50 mL graduated digestion tube containing 2% HCl. Bring to 50 mL final volume.

8.9.2.4 **1000 µg/L LCS and Matrix Standard for Tissues and Soils/Sediments:** Prepare by adding 0.1 mL of 1000 mg/L stock (8.9.2) to a 100 mL volumetric flask containing 2% HCL. This standard is identified as **I-date-V** in the Mercury Standards Preparation Log.

8.10 Calibration and Calibration Check Standards

8.10.1 Standards Preparation for Method 7474 Tissues

To 50 mL screw cap digestion tubes, add 10 mL of DI water and 2 mL of concentrated HNO3. Add the volumes of each standard as indicated in the table below, 2 mL of BrCl solution and bring to 50 mL. The standard set is designated in the Mercury Standards Preparation Log as **C-date-VM1,2,3...** (for calibration standards) and **I-date-VM1,2,3...** (for the ICV) as successive sets of standards are prepared from the stock. The same volume of the 1000 µg/L ICV stock is added to the preparation batch LCS and matrix spike sample.

If more than 2 mL of BrCl solution was added to samples to maintain the yellow color, add the same amount to standards. 0.2 mL of 12% hydroxyl amine hydrochloride is added to each vial and shaken. The yellow color should disappear.

8.10.2 Standards Preparation for Method 7474 Soils/Sediments

To 50 mL screw cap digestion tubes, add 10 mL of DI water, 0.75 mL of concentrated HCl and 0.25 mL of concentrated HNO_3. Add the volumes of each standard as indicated in the table below, 2 mL of BrCl solution and bring to 50 mL. The standard set is designated in the Mercury Standards Preparation Log as **C-date-VH1,2,3...** (for calibration standards) and **I-date-VH1,2,3...** (for the ICV) as successive sets of standards are prepared from the stock. The same volume of the 1000 µg/L ICV stock is added to the preparation batch LCS and matrix spike sample.

If more than 2 mL of BrCl solution was added to samples to maintain the yellow color, add the same amount to standards. 0.2 mL of 12% hydroxyl amine hydrochloride is added to each vial and shaken. The yellow color should disappear.

8.10.3 Calibration, Calibration Check Standards, LCS and Matrix Spike

Calibration and calibration check standards are prepared by adding standard volumes to vials prepared for tissues and soils/sediments as designated in the following table:

Standard ID	Vol. 1000 µg/L (mL) (Sec. 8.9.1.1 or 8.9.1.2)	Vol. 100 µg/L (mL) (Sec. 8.9.1.3)	Vol. 10 µg/L (mL) (Sec. 8.9.1.4)	Final Concentration (µg/L)
STD0	-	-	-	0.0
STD1	-	-	0.25	0.05
STD2	-	0.05	-	0.1
STD3	-	0.25	-	0.5
STD4	0.1	-	-	2.0
STD5	0.25	-	-	5.0
STD6	0.50	-	-	10.0
ICV, CCV	0.25 (Sec. 8.9.2.1 or 8.9.2.2)			5.0
LCS, MS	0.25 (Sec. 8.9.2.4)			5.0

Lower detection limits and analytical reporting limits may be required at times for some samples. Lower limits are attained by increasing the instrumental gain from 10 to 100 and by calibrating using lower concentration standards. Calibration standards and the LCS and MS are prepared as in the following table:

Standard ID	Vol. 5 µg/L Standard (Section 8.9.1.5) (mL)	Final Concentration (µg/L)
STD0	-	0.000
STD1	0.05	0.005
STD2	0.10	0.010
STD3	0.20	0.020
STD4	0.50	0.050
STD5	1.0	0.100
STD6	2.0	0.200
ICV,CCV,LCS, MS	1.0 (Section 8.9.2.3)	0.100

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 Blanks

9.1.1 Method Blank

A method blank must be prepared once per every 20 samples or per digestion batch, whichever is more frequent.

Mercury must not be detectable in the method blank at a concentration greater than the reporting limit.

Corrective Action: Analysis according to the appropriate analytical SOP may be repeated once to see if an analytical error has occurred. Digestion of the method blank and all associated samples must be performed until the blank is in control. Samples cannot be analyzed until an acceptable method blank analysis is obtained. Exceptions may be made with approval of the Metals Department Manager, Laboratory Director or QAO, if the samples associated with the out of control method blank are non-detect for the elements of interest, or if sample concentrations are greater than 10x the blank levels. In such cases, the sample results are accepted without corrective action for the high method blank and the client is notified in a project narrative associated with the sample results.

9.1.2 Initial Calibration Blank (ICB)

An initial calibration blank must be analyzed immediately following the ICV (see 9.3).

Mercury must not be detectable in the ICB at a concentration greater than the reporting limit.

Corrective Action: May reanalyze the standard once. If the concentration still exceeds the acceptance limit, stop and recalibrate the instrument. Samples cannot be analyzed until an acceptable ICB analysis is obtained. Exceptions may be made with approval of the Metals Department Manager, Laboratory Director or QAO, if the samples associated with the out of control blank are non-detect for mercury, or if sample concentrations are greater than 10x the blank levels. In such cases, the sample results are accepted without

corrective action for the high blank and the client is notified in a project narrative associated with the sample results.

9.1.3 Continuing Calibration Blank

A continuing calibration blank must be analyzed immediately following the CCV (see 9.4).

Mercury must not be detectable in the CCB at a concentration greater than the reporting limit.

Corrective Action: May reanalyze the standard once. If the concentration still exceeds the acceptance limit, stop, recalibrate the instrument and reanalyze all associated samples. Samples cannot be analyzed until an acceptable CCB analysis is obtained. Exceptions may be made with approval of the Metals Department Manager, Laboratory Director or QAO, if the samples associated with the out of control blank are non-detect for the elements of interest, or if sample concentrations are greater than 10x the blank levels. In such cases, the sample results are accepted without corrective action for the high method blank and the client is notified in a project narrative associated with the sample results.

9.2 Laboratory Control Sample (LCS)

Laboratory control sample (LCS) must be prepared once per every 20 samples or per digestion batch, whichever is more frequent, and spiked with a solution prepared from a second source or lot number, other than the source used to verify the accuracy of the standard curve for the determinative analytical method. The LCS contains all target elements of interest, and is digested along with the samples as verification of the accuracy of the entire digestion procedure.

The acceptable recovery QC limits are 80 – 120%. The recovery limits are continuously monitored and documented in-house through control charts. The *Control Limit Generation* SOP (08-07) provides details explaining how control charts are generated and used for quality control.

Corrective Action: Analysis according to the appropriate analytical SOP may be repeated once to see if an analytical error has occurred. If the LCS recovery is still out of control, re-prepare and re-analyze the LCS and all associated samples. Samples cannot be reported until an acceptable LCS is obtained. Exceptions may be made with approval of the Metals Department Manager, Laboratory Director or QAO, if the samples associated with the out of control LCS are also associated with a matrix spike that is in control. This is an acceptable measure of accuracy of the digestion and analytical procedures. An explanation of the out of control LCS recovery must be included in the project narrative to the client and the sample data reported noting the acceptable MS results as batch QC.

9.3 Initial Calibration Verification (ICV)

An initial calibration verification standard from a source different from that used to calibrate the instrument (see 8.9.2) must be analyzed immediately following calibration as an independent check of instrument performance. Nominal acceptance limits are 90% - 110% of the true value.

Corrective Action: May reanalyze the standard once. If the concentration still exceeds the acceptance limit, stop and recalibrate the instrument. Samples cannot be analyzed until an acceptable ICV analysis is obtained. Exceptions may be made with approval of the Metals Department Manager, Laboratory Director or QAO, if the samples associated with a high recovery ICV are non-detect. In such cases, the sample results are accepted without corrective action for the high ICV recovery and the client is notified in a project narrative associated with the sample results.

9.4 Continuing Calibration Verification (CCV)

A continuing calibration verification standard must be analyzed after analysis of no more than 10 samples as an on-going check of instrument performance. Nominal acceptance limits are 90% - 110% of the true value.

Corrective Action: May reanalyze the standard once. If the concentration still exceeds the acceptance limit, stop, recalibrate the instrument and reanalyze all associated samples. Results cannot be accepted until an acceptable CCV analysis is obtained. Exceptions may be made with approval of the Metals Department Manager, Laboratory Director or QAO, if the samples associated with a high recovery CCV are non-detect. In such cases, the sample results are accepted without corrective action for the high CCV recovery and the client is notified in a project narrative associated with the sample results.

9.5 Matrix Spike

A matrix spike (MS) sample must be performed once per 20 samples (5% frequency), or per digestion batch, whichever is more frequent. The MS contains all target elements of interest.

The acceptable % recovery QC limits are 75% – 125%. The % recovery QC limits are continuously monitored and documented in-house through control charts. The *Control Limit Generation* SOP (08-07) provides details explaining how control charts are generated and used for quality control.

Corrective Action: Analysis according to the appropriate analytical SOP may be repeated once to see if an analytical error has occurred. If the % recovery still exceeds the control limits and the LCS is compliant, include a project narrative with the results to the client noting that there may be potential matrix effects on the accuracy of the reported results as evidenced by MS recovery outside of QC limits.

9.6 Laboratory Duplicate

Duplicate analyses (matrix or sample duplicate) must be performed once per 20 samples 5% frequency), or per digestion batch, whichever is more frequent.

Acceptable relative percent differences (RPD) of duplicates is ≤ 20%. This acceptance criterion is not applicable to sample concentrations less than 5 times the reporting limit. Calculate the RPD as follows:

$$RPD = \frac{R1 - R2}{\frac{[R1 + R2]}{2}} \times 100$$

where:

R1 = sample Replicate #1
R2 = sample Replicate #2

The RPD limits are continuously monitored and documented in-house through control charts. The *Control Limit Generation* SOP (08-07) provides details explaining how control charts are generated and used for quality control.

Corrective Action: Analysis may be repeated once to see if an analytical error has occurred. If the % RPD still exceeds the control limits; include a project narrative with the results to client noting that there may be potential matrix effects on the precision of the reported metals results as evidenced by the matrix duplicate %RPD exceedance.

9.7 Method-specific Quality Control Samples

None.

9.8 Method Sequence

- ICV
- ICB
- Method Blank
- Laboratory Control Sample
- Matrix QC Sample
- Matrix Duplicate
- Matrix Spike
- Samples 2-5
- CCV
- CCB
- Samples 6-15
- CCV
- CCB

10. Procedure

10.1 Equipment Set-up

Samples are prioritized by the Metals Department Manager or Preparation Group Leader for digestion based on hold time and client due date. The analyst must be familiar with instrument software and hardware as described in the user manuals supplied with the instrument before attempting to perform an analysis.

Power to the instrument, autosampler , PC and the argon gas supply are turned on. Peristaltic pump windings are inspected for wear and replaced if necessary. The winding clips are relaxed in between usage. The instrument manufacturer suggests that the pump tubing be changed once per month or more frequently as needed.

The stannous chloride solution is attached to the grey/grey pump tubing, 10% HCl is attached to the green/green autosampler rinse and DI is attached to the geen/green rinse blank. The autosampler probe line is attached to a grey/grey pump tubing. The pumps are turned on via the software and the flow is checked to insure that solutions are delivered to the mixing valve.

10.1.1 Sample Preparation

10.1.1.1 Tissues

Tissue samples are prepared by microwave oven assisted acid digestion according to SOP MP-003. The LCS and MS are spiked as indicated in the table in 8.10.3.

A 10 mL aliquot of each digest is added to a 50 mL screw cap digestion tube along with 2 mL of BrCl solution. The vial contents should remain a yellow color. If a yellow color does not remain, add more BrCl solution. This solution is

allowed to stand for 12 hours. Bring the vial to 50 mL with DI water . The vials are then decolorized with 0.4 mL of 12% hydroxyl amine hydrochloride and shaken. The yellow color should disappear. If the solution remains yellow, add more hydroxyl amine until the color disappears. Add the same amount to all samples and standards.

10.1.1.2 Soils/Sediment

A 0.5 – 1.0 g wet weight well mixed aliquot of soil/sediment is added to a 50 mL screw cap digestion tube with 5 mL of DI water. The LCS and MS are spiked as indicated in the table in 8.10.3. A 3.75 mL volume of concentrated HCl and 1.25 mL of concentrated HNO_3 are added and the tube placed on the hot block set to 95 ± 3 °C for 2 minutes. Samples are allowed to cool and then 25 mL of DI water is added to each vial and placed back on the hot block for 30 minutes.

After cooling bring to a final volume of 50 mL with DI water. Then a 10 mL aliquot of each digest is added to a 50 mL screw cap digestion tube along 2 mL of BrCl solution. The vial contents should remain a yellow color. If a yellow color does not remain, add more BrCl solution. Bring the vial to 50 mL with DI water. The vials are then decolorized with 0.4 mL of 12% hydroxyl amine hydrochloride and shaken. The yellow color should disappear. If the solution remains yellow, add more hydroxyl amine until the color disappears. Add the same amount to all samples and standards

10.2 Initial Calibration

The instrument is calibrated prior to sample analysis and at least once every 24 hours. A linear least squares regression calibration curve is selected for Method 7474.

In all cases, a correlation coefficient ≥ 0.995 is required before the analysis of samples can begin. The calibration blank is included as a point in the calibration curve.

An ICV (Section 9.3) and ICB (Section 9.1.2) are analyzed after calibration.

10.3 Equipment Operation and Sample Processing

After initializing the Millennium software, the instrument is turned on via the software and allowed to warm up for 30 minutes. The analysis method is selected and the autosampler template is selected. Method 7474 is set up in the software which specifies delay, read and rinse times as well as pump speeds. An autosampler template is set up specifying calibration standard, QC standards and positions on the autosampler rack. Once sample ID's have been typed in, the file is saved as the Job number.

A Work Group is obtained from LIMS and used as the data file name.

The analysis is initiated by clicking on the start button on the analysis page.

Following analysis, the data file is exported to the LIMS on the O:Metals\Millennium drive for data processing. The instrument and autosampler are then rinsed with DI water and turned off

10.4 Continuing Calibration

Periodically (after no more than 10 samples) and at the end of the analysis, CCV standards (Section 9.4) and CCB standards (Section 9.1.3) are analyzed.

10.5 Preventive Maintenance

Inspect pump tubing for signs of wear and replace monthly or more frequently if necessary.

Clean glass liquid separator when glass appears coated with yellow film.

Replace dryer tube annually.

11. Data Evaluation, Calculations and Reporting

Procedures for data and record management must adhere to the Quality Systems Manual, other subordinate documents covering record keeping, and the *Document Control* SOP (08-01). All records must be stored in such a manner as to be safe and accessible for at least 10 years.

The digestion batch bench sheets and other relevant laboratory notebooks must follow the specifications in the *Laboratory Notebook Usage* Work Instruction (108-01), and all record keeping and document control practices.

Sample concentrations are calculated as follows:

Sample Concentration = ((Dc*Df)*Dv)/((Md*(S%/100)*1000))

Where:

Dc = digest Concentration in µg/L
Df = Dilution factor
Dv = Digest volume in mL
Md = Mass of sample digested in g
S% = percent solid of the sample (if reported on wet weight basis then percent solid = 100)

All results are reportable without qualification if digestion and analytical holding times are met, preservation (including cooler temperatures) are met, all QC criteria defined in the table below are met, and matrix interference is not suspected during digestion or analysis of the samples. If any of the below QC parameters are not met, all associated samples must be evaluated for re-extraction and/or re-analysis.

QC Parameter	Acceptance Criteria
Method Blank	< reporting limit
Laboratory Control Sample	80%-120% Recovery
Matrix Duplicate	≤ 20% RPD
Matrix Spike	75% - 125% Recovery
Matrix Spike Duplicate (if needed)	≤ 20% RPD, 75% - 125% Recovery

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

Section 9 outlines sample batch QC acceptance criteria. If non-compliant results are to be reported, the Metals Department Manager and/or the Laboratory Director, and the QA Manager must approve the reporting of the results. The laboratory Project Manager shall be notified, and may chose to relay the non-compliance to the client, for approval, or other corrective action, such as re-sampling and re-analysis. The instrument analyst or Department Manager performing the secondary analytical review initiates the project narrative, and the narrative must clearly document the non-compliance and provide a reason for acceptance of these results.

13. Method Performance

13.1 Method Detection Limit Study (MDL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

The laboratory follows the procedure to determine the MDL, LOD, and/or LOQ as outlined in Alpha SOP/08-05. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

Refer to Alpha SOP/08-12 for further information regarding IDC/DOC Generation.

13.2.1 Initial (IDC)

The analyst must make an initial, one-time, demonstration of the ability to generate acceptable accuracy and precision with this method, prior to the processing of any samples.

13.2.2 Continuing (DOC)

The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method

13.3 Instrument Detection Limits

The instrument detection limit (IDL) is the smallest signal above the background noise that an instrument can detect. The IDL can be calculated taking the average of the standard deviations for three measurements of a reagent blank solution analyzed on three analytical runs on three non-consecutive days. Seven consecutive measurements must be taken per day. The IDLs are not required to go through sample digestion. Each measurement must be performed as though it were a separate sample.

14. Pollution Prevention and Waste Management

The *Hazardous Waste and Sample Disposal* SOP (G-006) must be referenced for disposal of used standards, solvents, acids, reagents or other chemicals.

Once sample batches have completed digestion, the sample containers are stored in the metals lab and held for 30 days. If there is no sample remaining in the sample collection bottle, it may be rinsed and thrown away. It must be noted in the *Internal COC* that there is no sample remaining in the bottle, and the bottle was discarded.

Once satisfactory results have been generated, the digestates are held for 30 days, or longer if specified by a client contract, then discarded into a 55-gallon drum labeled "Corrosive Liquid".

All reagent waste generated during digestion must be stored in satellite containers in the metals preparation laboratory.

Once the reagent waste satellite containers are full, they must be emptied into 55-gallon drums marked "Corrosive Liquid".

Refer to Alpha's Chemical Hygiene Plan and Waste Management and Disposal SOP for further pollution prevention and waste management information.

15. Referenced Documents

Chemical Hygiene Plan

SOP/01-01 Sample Receipt & Log-In

SOP/08-01 Document Control

SOP/08-05 MDL/LOD/LOQ Generation

SOP/08-07 Control Limit Generation

SOP/08-12 IDC/DOC Generation

SOP/G-006 Hazardous Waste and Sample Disposal

SOP/MP-003 Microwave Assisted Acid Digestion of Sediments, Soils, Tissues and Waters

WI/108-01 Laboratory Notebook Usage

16. Attachments

None.

Soil Field Screening Procedures

Each soil core should be screened with a properly calibrated direct reading instrument (DRI) equipped with a PID or FID detector or other suitable field-screening instrument capable of detecting the contaminants of concern pursuant to N.J.A.C. 7:26E-2.1(b).

To obtain the most representative monitor reading, use a decontaminated stainless steel spoon, knife or other appropriately constructed device and make a longitudinal score deep enough to expose a porous surface the length of the core. Or optionally, make very small divots at six-inch intervals to expose a porous surface. Simultaneously, place the probe of the DRI immediately above the opened area being careful not to touch the sample, and move the probe slowly above the lateral scoring and note any peaks. Record results of peaks in 6-inch intervals to determine sample location. Instrument readings will be biased low and not representative of in-situ conditions if the soil core is not scored or inner core not exposed for proper field screening. Other methods of field screening (e.g., bag headspace, jar headspace, warming, UV light, dye testing etc.) should be discussed with the appropriate regulatory authority for approval before sample collection.

The Technical Requirements for Site Remediation N.J.A.C. 7:26E-3.6(a)4.(ii), instruct one to select a six-inch increment of soil for volatile organic laboratory analysis based on field screening with a DRI. If a boring is continuously cored to 20 feet below grade where ground water is first encountered, then 4 to 5 individual 48" - 60" soil core segments will have to be opened and screened before determination as to which six-inch increment is to be selected for sampling and analysis. Special attention must be paid to labeling and storage of individual core samples when continuous soil samples are collected from a single boring. In many instances soil cores can be produced faster than they can be opened, logged, screened and sampled by a technician. In those instances when a backlog of cores are being generated, care must be made to protect the cores from direct sunlight, excessive ambient temperatures and rain. These conditions may have an adverse effect on highly sensitive volatile organics within the core or the instruments used for screening. Always keep the cores labeled so that the up/down orientation is not lost. Proceeded carefully, but quickly when field screening. If necessary, log soils for lithology information *after* sample collection. Always calibrate the DRI at the start of each day.

Another option is to select (using the DRI), and sample (using a small diameter coring device), a six-inch increment from every individual core segment, and only submit the sample required from that particular boring for analysis as directed in 7:26E-3.6(a)4(ii). This option can be more costly as several sample containers will have to be discarded at the end of the each boring. If chemical preservation is used (methanol), proper disposal could be an issue. Sampling every individual core first, prior to determining which increment to ship for laboratory analysis will also require additional labor. This particular option, to collect a representative six-inch incremental sample from every individual segment of a continuous core with its associated cost, makes the first option to carefully protect and manage the cores to control the loss of volatile organics even more critical. **(Section 6.2.6)**

Water Quality Parameter Procedures

N.J.A.C. 7:18 requires that any environmental laboratory* submitting analytical data to the Department, regardless of quality level, must be certified by the Office of Quality Assurance. This applies to those firms using LFPS instruments associated with the "analyze immediately" category of water quality indicator parameters (WQIPs) including pH, temperature, and dissolved oxygen. Regardless of whether or not the equipment in question is rented or privately owned the requirement for certification cannot be ignored. All certification documentation must accompany the instrument into the field and accompany all WQIP data submitted to the Department. (*Environmental laboratory is defined as any laboratory, facility, consulting firm, government or private agency, business entity or other person that the

Department has authorized, pursuant to N.J.A.C. 7:18, to perform analysis in accordance with the procedures of a given analytical method using a particular technique as set forth in a certain methods reference document and to report the results from the analysis of environmental samples in compliance with a Departmental regulatory program). **(Section 6.9.2.2.4)**

Prior to sample collection, water body characteristics (e.g., size, depth, and flow) should be recorded in the field logbook. Water quality measurements shall include temperature, pH, total hardness (as $CaCO_3$), alkalinity (as $CaCO_3$), salinity (parts per thousand, 0/00), conductivity (as *u*nhos/cm), and dissolved oxygen (mg/l). These measurements must be properly documented as per Chapter 10, *Documentation*. Non-aqueous data must be accompanied by laboratory-analyzed total organic carbon (TOC) and particle grain size for each sample. **(Section 6.8.1.2)**